ELECTRICAL WORLD

MAY 16, 1931
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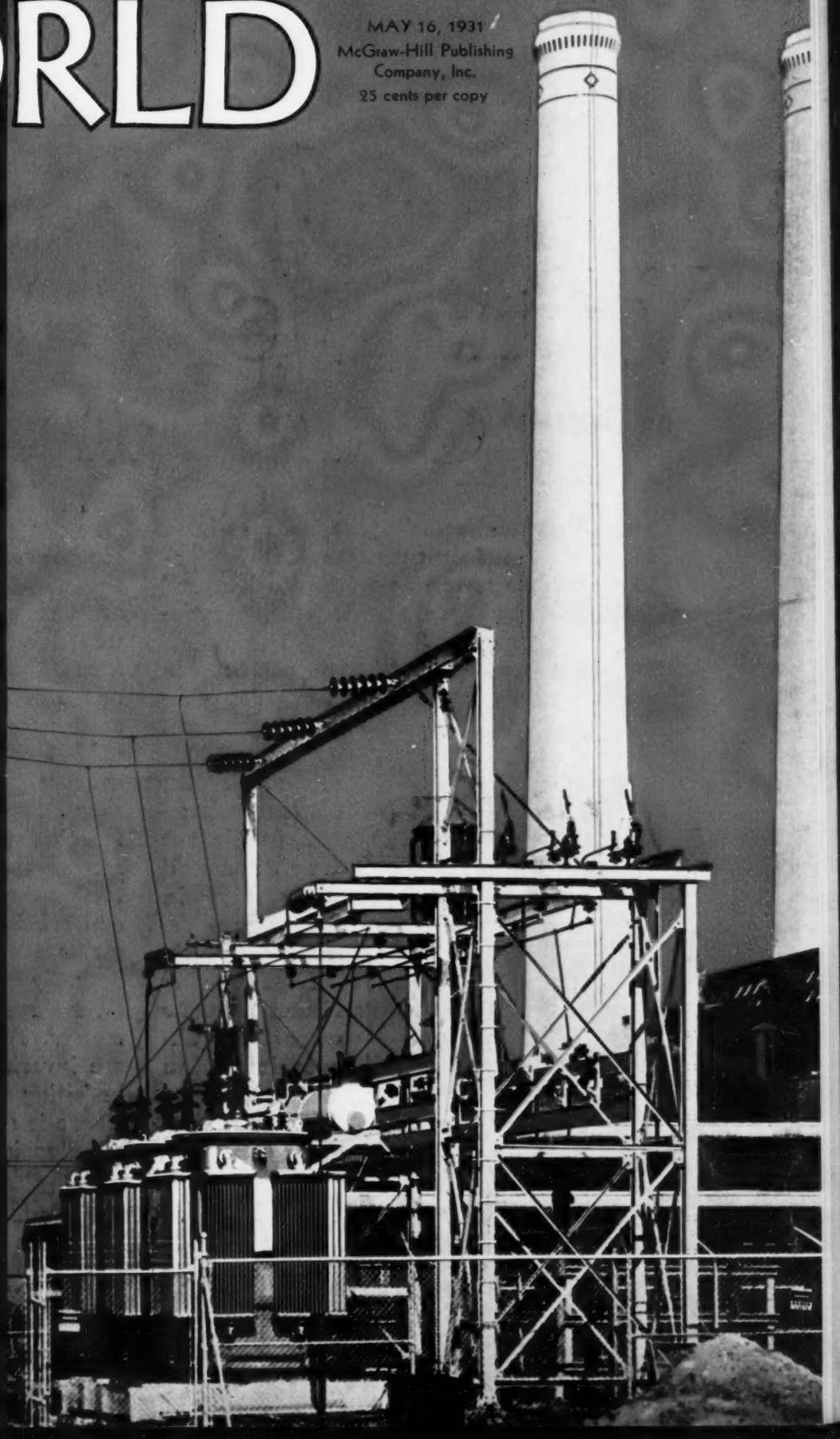

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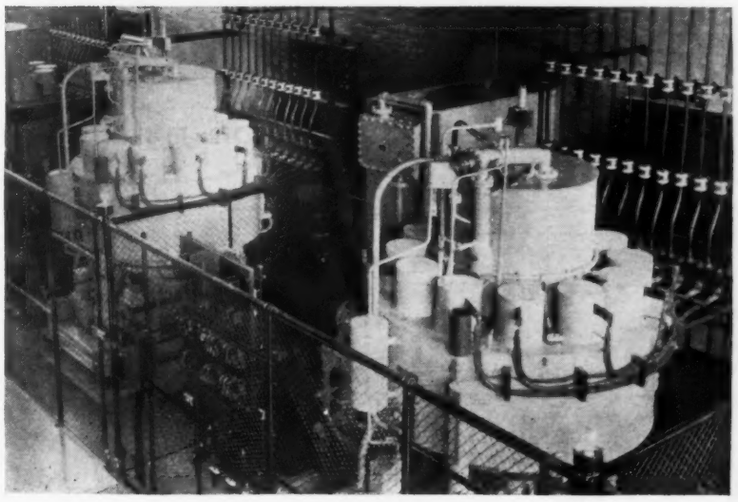

3,000-volt d.c., 3,000-kw. mercury-arc rectifiers, Lackawana Railroad

MAY 16, 1931

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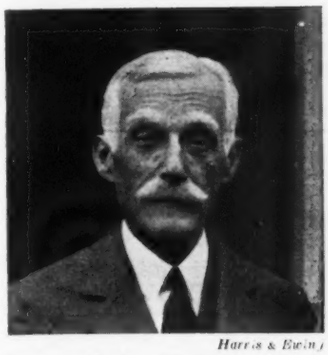
As Simple as a Pencil

ELECTRICAL WORLD

for the Week Ending

May 16, 1931



Harris & Ewing

I do not believe in any quick or spectacular remedies for the ills from which the world is suffering. Our present experience indicates that the machine cannot be made to function at full speed all the time.

I have no means of knowing when or how we shall emerge from the valley in which we are now traveling. But I do know that, as in the past, the day will come when we shall find ourselves on a more solid economic foundation and the onward march of progress will be resumed.

ANDREW W. MELLON,
Secretary of the Treasury.

South Carolina to tax all power

—**Energy levies are increasing.** South Carolina joins Idaho and Vermont in placing one-half mill tax on all hydro or steam generated electricity. Just another layer of taxation?—*p. 890.*

—**Aerial cable on rural line** supplants open wire construction to meet difficult wooded-stretch conditions. Ingenious expedients adopted to minimize investment costs—*p. 916.*

Walls may heat the ultra-modern room

—**Heated solely by radiation,** rooms may lose all visible sources of heat. Westinghouse experiments with advanced panel type of electric heating. Commercial installations may follow—*p. 892.*

—**Better production conditions** result in metal-working plant as the result of installing electric rod heaters. Quality of output improved and work speeded too, it is said—*p. 908.*

Michelson's brilliant career ends

—**Physicist reports experiment** to eliminate last error in determinations of speed of light before passing on. Preceptor of great physicists, inspiration of Einstein, insatiable seeker of cosmic facts departs at 78—*p. 924.*

—**Powder plant's wiring layout** requires special provision to allow for widely dispersed load points and to obviate fire and explosion hazards. Numerous transformers serve 2,300-volt radial system here—*p. 919.*

Why Ontario board purchases energy

—**Wiring for the modern club** means adequate provisions for special events, radio, signal and communication systems. An electrical engineer outlines his suggestions for all-around satisfaction—*p. 900.*

—**Ontario Hydro defends self** in purchase of Quebec power from private plants on basis of necessity. Demand for energy precluded delay to establish river rights and undertake construction. Policies seen unaffected—*p. 893.*

Leaders of Industry Will Talk on Today's Problems at N.E.L.A. Convention

BECAUSE of business conditions generally and the unusual amount of public interest in utility problems at this time, particular attention will be paid at the Atlantic City N.E.L.A. convention next month to such questions as public and trade relations, the government in business, the future of the light and power industry, potential markets for electrical energy, the public utilities as shock absorbers, public utility advertising, mass production, rate structures and regulation.

The convention will be opened at 10 a.m., Tuesday, June 9, in the ballroom of the Atlantic City Auditorium, with President Jones in the chair. It will be preceded on Monday by committee meetings and the president's reception. As previously reported, there will be four general sessions on the mornings of Tuesday to Friday inclusive, the afternoons being devoted to sessions of the Engineering, Accounting, Commercial and Public Relations National Sections. The meeting of the women's committee will be held in the Hotel Claridge.

Speakers at the opening session will be President Jones and Managing Director Clapp, M. H. Aylesworth, president National Broadcasting Company; Harry Reid, chairman Public Relations National Section; David Lawrence, editor and publisher *United States Daily;* R. F. Pack, former president N.E.L.A., and Treasurer P. S. Young.

The program of the second general session, Wednesday morning, will include E. W. Goldschmidt, chairman of the exhibition committee; Judge William Lynn Ransom, J. F. Owens, first vice-president N.E.L.A., who will discuss trade relations; T. O. Kennedy, vice-president Ohio Public Service Company, and Gus W. Dyer, editor *Southern Agriculturist.* Unusual demonstrations, entitled "Energy Through Space," will be made by the General Electric Company.

The third general session, on Thursday, will open with the memorial report by W. H. Onken, Jr., vice-president Security Owners' Association. C. E. Groesbeck, president Electric Bond & Share Company, will discuss the possible connection between the world-wide depression and governmental incursions into the business field. He will be followed by W. C. Mullendore, vice-president Southern California Edison Company, whose speech on "The Power Industry and Political Sabotage" before the Pacific Coast Electrical Association last February aroused great interest. This session will close with an address by Samuel Insull.

At the fourth general session, on Friday, such men as Gerard Swope, president General Electric Company; Marshall E. Sampsell, president Society for Electrical Development; Edwin Gruhl, vice-president North American Company; Franklyn Heydecke, general auditor Public Service Electric & Gas Company, and Frank W. Smith, vice-president United Electric Light & Power Company, will be heard and the prize awards will be presented.

The public policy session will be held on Thursday evening. After announcing the winner of the Charles A. Coffin medal Preston S. Arkwright, chairman of the public policy committee, will make his report. He will be followed by Merle Thorpe, editor of *Nation's Business,* who will speak on "Our Vanishing Economic Freedom."

The Engineering Section program will include papers on "Economic Wastes," by George N. Tidd, president American Gas & Electric Company; "Smoke Problems," by Harvey N. Davis, president Stevens Institute of Technology, and "Distribution Costs" by A. C. Marshall, vice-president Detroit Edison Company. At the meeting of the Public Relations Section Chairman Joseph B. Groce of the advertising and publicity committee will discuss its work. He will be followed by James B. Black, North American Company, who will speak on "Customer Ownership." Homer Ferguson, past-president United States Chamber of Commerce, will discuss "Government in Business," and Homer E. Niesz will talk on employee training. The Commercial and Accounting Section programs also will be practical and timely. The women's committee will be addressed by Miss Clara Zillessen, advertising manager Philadelphia Elec-

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ROOSEVELT'S ST. LAWRENCE POWER AUTHORITY TRUSTEES TAKE OFFICE

—Wide World Photos

Left to right—James C. Bonbright, Delos Cosgrove, Frank P. Walsh, Fred Freestone.

Meeting for organization at Albany on Tuesday, the trustees of the Power Authority of the State of New York, appointed by Governor Roosevelt just before he sailed for Europe (ELECTRICAL WORLD, *May 9, page 838), elected Frank P. Walsh of New York City chairman, Delos Cosgrove of Watertown vice-chairman and Prof. James C. Bonbright of New York secretary. Acting Governor Lehman is seated. The fifth member of the body, Morris L. Cooke of Philadelphia, was unable to be present,*

tric Company; W. S. Vivian, chairman public speaking committee, and Martin J. Insull, who will discuss "The Employee's Part."

▼

South Carolina Taxes All Generated Energy

SOUTH CAROLINA has now joined Idaho and Vermont by passing a measure to impose a tax of one-half mill on all energy generated in the state, hydro or steam. Idaho passed such an act in March and Vermont in April. Governor Ibra C. Blackwood of South Carolina signed the bill of which the passage was noted last week on May 9.

The South Carolina bill was bitterly contested. The Lower House killed it three times before its arrival in final form in the Governor's office, and the Upper House strugged through a series of debates before it was approved by that body. The tax is expected to create an annual revenue of $600,000.

Opponents of the bill contended that it would blight industrial development and that the state was breaking faith with the Lexington Water Power Company, which recently completed the large Saluda development, by passing the bill. Proponents argued that the tax merely placed a small levy on the companies for the use of the state's rivers.

A bill imposing a tax of 0.5 mill on hydro power only was killed by the House on March 17 by three votes. Almost immediately another bill was introduced proposing a tax of 0.3 mill on hydro-power. This measure was killed by 47 to 39 by the House, which a moment later applied the "parliamentary clinches" to prevent the bill from being resurrected. The Senate passed the half-mill power tax as a rider to the appropriation bill, but when that bill was returned to the Lower House it was rejected. Prior to the vote the "power trust" was charged with lobbying. Last week the House reversed itself and as a separate measure passed a bill imposing the half-mill tax on all power produced in the state.

▼

Pennsylvania Senators Defeat Pinchot Bills

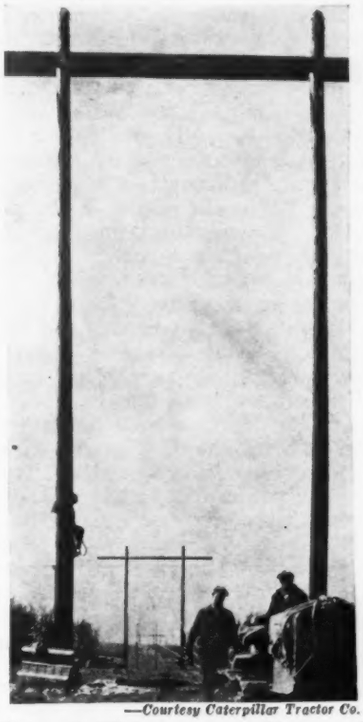
GOVERNOR PINCHOT'S three bills to abolish the Pennsylvania Public Service Commission, establish instead a Fair Rate Board and amend the present public service law were virtually killed on Tuesday, when the judiciary general committee of the Senate, following its public hearings upon them, voted to postpone action indefinitely. Attorney-General Schnader had previously made some changes in the bills, eliminating both the clause returning profits in excess of 7½ per cent to the treasury and that setting a 50-year limit to franchises; but these amendments were not laid before the judiciary committee, which divided thirteen to ten, fourteen to eleven and fifteen to nine against the respective bills.

Monday was opponents' day in the hearings, and as part of the testimony two of the bills were declared unconstitutional by Robert von Moschzisker, former chief justice of the Pennsylvania Supreme Court—the one setting up the Fair Rate Board, because of its delegation of legislative powers by statute, and the one embodying the "prudent investment" valuation theory, because it would result in confiscation.

Utility and industrial heads who argued against the measures included John E. Zimmermann, president United Gas Improvement Company, who called the bills "unfair, unworkable and impracticable" and said it was obvious that the prescribed excessive control of the utilities could lead to virtual confiscation; Frank R. Phillips, president of the Philadelphia Company, Pittsburgh, who said the measures' enactment would halt public utility expansion; railroad counsel, who paid high compliments to W. D. B. Ainey, chairman of the present commission; Alba B. Johnson, president Pennsylvania State Chamber of Commerce, who asserted that the bills "looked like persecution"; Thomas F. Woodlock, former member of the Interstate Commerce Commission, who thought "prudent investment" valuation would paralyze the utility industry in financing and extending service, and a number of others, among them A. W. Robertson, chairman of the Westinghouse board of directors.

In the meantime Governor Pinchot kept up his barrage against the recalcitrant senators of his own party, visiting their home districts to attack them on the stump and utilizing every resource of public statement by newspaper and radio, argument and anathema, to make his will prevail. When he was apprised of the Senate committee's final action he indulged in strong condemnation of it, stigmatizing the opposing senators as servants of the utilities and their disposition of the bills as being "what I call service."

STRINGING THE OSAGE LINE



—Courtesy Caterpillar Tractor Co.

Stone & Webster are making good progress with the transmission lines from the Bagnell Dam to St. Louis. The five leads being strung in by the tractor, three 336,400-circ.mil A.C.S.R. and two ⅛-in. steel wires, go at the rate of three miles per day.

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Power and Regulation in State Legislatures

ALABAMA.—A joint resolution has been introduced authorizing Governor Miller to appoint a commission to confer with a similar commission from Tennessee, a member of the National Farm Bureau and a member of the Engineering Corps of the army in an effort to find some disposition of the Muscle Shoals problem. The resolution is in keeping with a suggestion of President Hoover in his message vetoing the Norris bill for government operation. This resolution, sponsored by the Governor and thought to be favored by a majority of the Legislature, provides that the Governor shall not appoint any person on the commission "directly or indirectly connected with any power company or fertilizer company, nor shall he appoint any person whose interests might be adversely affected by quantity production of fertilizer or by sales of surplus power." The plan put forth must be for private lease and operation in the interest of agriculture and the development of the Tennessee Valley.

CONNECTICUT.—As the session draws to a close it is evident that Governor Cross has not got far with his program for changes in power utility regulation. Unable to persuade the Legislature to confirm his original nominee for the vacancy in the commission, Prof. R. J. Smith of Yale, he was, through the resignation because of illness of Commissioner Elwell, able to effect a compromise by reappointing

Commissioner Alsop for a full term and appointing E. L. Taylor, an engineer on his own staff, for Mr. Elwell's unexpired term of two years. With two former members holding majority power in the board of three, and with Professor Levitt's ouster proceedings probably doomed to failure, victory for the present seems to remain with the conservatives and the much-criticised dual rôle of J. Henry Roraback as utility president and party "boss" has not been subject to forced abandonment. A bill is now before the Legislature to strengthen the legal standing for investment purposes of utility voting-trust certificates.

FLORIDA.—Joe H. Gill of Miami, president Florida Power & Light Company, told the House finance and taxation committee on May 8 that to pay the proposed tax of half a cent a kilowatt-hour on electricity generated would mean a loss to his company of 25 to 30 per cent of its revenue. Peter O. Knight, president Tampa Electric Company, gave similar testimony and called the tax impossible. More equitable enforcement of the personal property tax was urged as an alternative to the attempted raid on the utilities, in which measures to tax gas 10 cents per 1,000 cu.ft. and telephones $4 a year are included. A bill to set up a public utilities commission has been introduced.

ILLINOIS.—A bill introduced by Senator Arthur A. Huebsch provides for the establishment of a state-wide system for the conservation of water power, for flood control, for forest and game preservation, recreational grounds and parks, and also empowers the state to produce electricity and sell it to utility companies. Senator Huebsch said that the power projects would be financed through bond issues and that income from the power sold would pay interest on the bonds and provide a sinking fund for their retirement.

PENNSYLVANIA.—The defeat of the Fair Rate Board bills in the Senate judiciary committee (reported on page 891) was accompanied by a favorable report on Senator McClure's bill amending the present public service law, and that bill was passed and sent to the House. It (1) provides for a people's counsel bureau in the Department of Justice to extend assistance to ratepayers and municipalities in the prosecution of complaints against public service companies; (2) requires the approval of the commission before changes in the rates can take effect; (3) limits the capitalization and financing of companies engaged in furnishing public utilities service, the transfer of franchises and rights and holding of capital stock of such companies by similar companies or other corporations; (4) regulates mergers, consolidations or reorganizations of such companies; (5) defines the duties of the Court of Appeals applying to orders of the commission, and (6) provides that orders of the commission shall be prima facie evidence except in rates cases. James S. Benn, for eleven years a member of the Public Setrvice Commission and nominated by Mr. Pinchot's predecessor for a new term, but not confirmed, has resigned in the interest of Republican harmony. He was a target for much of the Governor's denunciation.

TEXAS.—With the early adjournment of the Legislature in prospect, it is regarded as virtually certain that the House bill to prevent the sale of merchandise by utility companies will not get beyond its present low place on the calendar and is as good as dead. This is also true of the bill creating a state public utilities commission. The joint resolution submitting to popular vote a proposed constitutional amendment to permit the establishment of rural electric light, power and gas distribution districts failed to receive the necessary two-thirds vote in the Senate.

Westinghouse Has New Room-Heating Scheme

WARMTH THROUGH RADIATION is the aim of experiments now being conducted at the Westinghouse research laboratories at East Pittsburgh under the direction of L. W. Schad. A room has been built with a warm "skin"—that is, a surface impregnated with electric heating elements. The individual "scales" or sections forming the skin imitate ordinary wall and ceiling materials or can be covered with them. The walls have a finish of specially covered overlapping boards with a ceiling of soft, ivory-tinted material.

All the heat comes from walls and ceiling. The entire surface may be warmed, or the heat merely switched on section by section where it will do the most good. These walls do not glow or become hot to touch. They radiate a mild temperature almost exactly equal to that of the human body and feel barely warm to the touch.

Ordinarily the comfort of a room depends on the heat of its air, but the new room will be tested with air quite cool to learn whether the heat radiated by the human body in all directions can be used both for comfort and possibly to save fuel bills. Cold walls absorb this radiated heat rapidly. Whether the lesser absorption of mildly heated walls will produce a worth-while difference in physical comfort is one question the new room is designed to answer.

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Engineers Picked for Public Service Program

THIRTY-FIVE ENGINEERS have been appointed by the American Engineering Council to committees which will during the coming year carry out a program of public service. A wide

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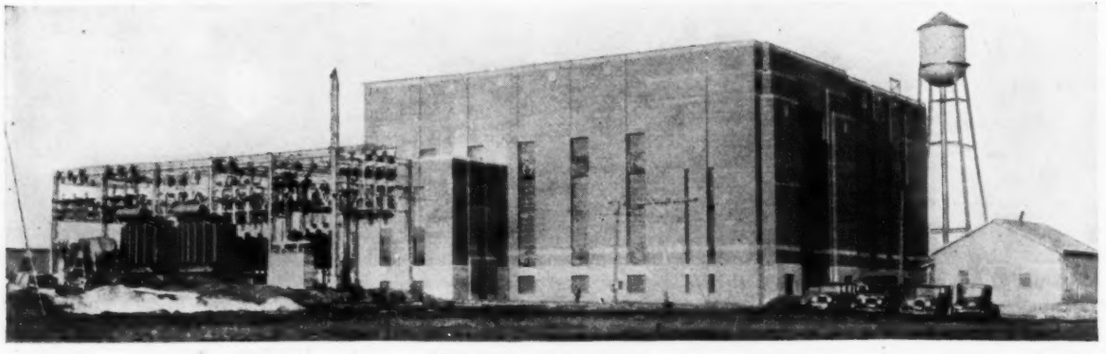
SHEBOYGAN'S NEW STEAM STATION WILL BE READY IN SEPTEMBER



Work on this Lake Michigan station of the Wisconsin Power & Light Company was started in April, 1930. There will be a second unit of the same size. Boilers and turbo-generators are installed in the same room.

range of activities is planned, including co-operation with the national government in administrative action affecting engineering, studies of proposed congressional legislation and economic investigations.

Among the appointments are those of C. O. Bickelhaupt of the American Telephone & Telegraph Company and H. A. Kidder of the Interborough Rapid Transit Company to the public affairs committee, which is preparing a program of engineering participation in federal affairs. Arthur W. Berresford, manging director of the National Electrical Manufacturers' Association and a past-president of the council, will be chairman of the committee on government reorganization, which will attempt to centralize under single control the public works functions of the federal government. Farley Osgood, past-president A.I.E.E., and John P. Hogan are also members of this committee.

▼

American Co-operation in British I. C. I. Meeting

PARTICULAR RESPONSIBILITY for four lighting topics which are to be discussed at the meeting of the International Commission on Illumination in Great Britain next September (ELECTRICAL WORLD, October 11, 1930, page 672) has been placed on the United States committee. These topics are motor-vehicle lighting, factory and school lighting, aviation lighting, and applied lighting practice in fields not otherwise specifically covered. The last two are new assignments in which there is special interest.

E. C. Crittenden of the Bureau of Standards, who is the president of the United States committee, reported earlier in the present year that, to provide a direct connection between the four subcommittees in charge of the subjects named, a special committee under the chairmanship of A. L. Powell has been formed, which will also assist and advise those who represent the United States on the fourteen projects managed by other national committees, thus serving as a general clearing house for American contributions.

On two important questions of standardization—lamp bases and sockets being one and photometry the other—the Illumination Commission's assistance was sought last year by other international organizations—respectively the International Electrotechnical Commission and the International Committee of Weights and Measures. In the latter case a new stimulus to agreement both upon a primary standard of light and upon a uniform method of measuring lights of widely diverse colors is expected to make itself felt.

Electric Hotbeds Please New York Gardeners

EXPERIMENTS IN electrically heated hotbeds used to germinate seeds for early planting are being carried on successfully by four Albany area market gardeners who believe in the application of modern science to farm problems. Different types of insulation and heating units are being employed, and peppers and other plants difficult to raise in cold weather have been forced above the ground in nine days.

The four hotbeds are each 6 ft. by 12 ft. Three types of heating units are used—resistance wire in lead-covered cable, bare resistance wire and strip heating units, all of which maintain a constant supply of heat, the units being automatically controlled by thermostats. The various means of insulation include mineral wool, cork, cellotex, cinders and thermo-fill. As a result of these experiments the most economical and efficient heating unit and means of insulation will be determined.

Advantages compared with manure hotbeds are enumerated as constant supply of heat, which, owing to thermostatic control, does not diminish; permanent installation, a smaller degree of attention, cleanliness, freedom from ammonia fumes, and a smaller cost of operation over a period of time.

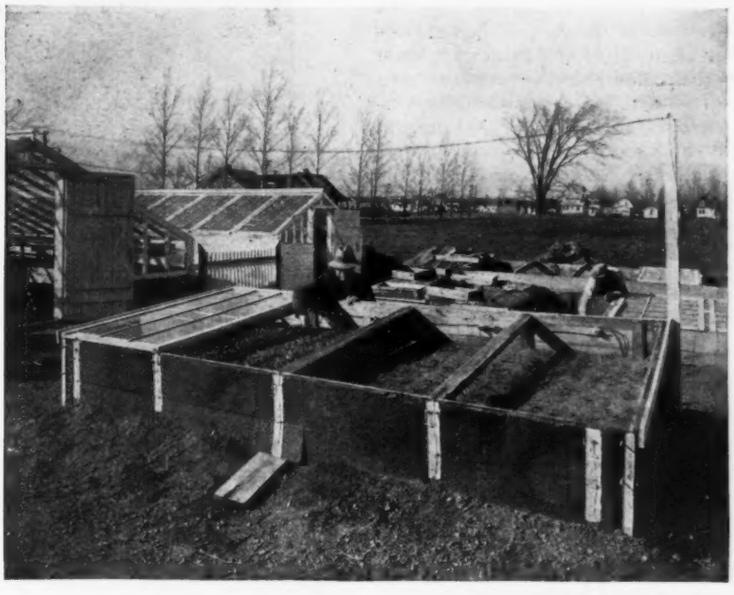
While these electrical hotbeds are comparatively new to America, they have been in use since 1922 in Sweden and Norway. In 1929 there were nearly 300 such hotbeds in use in Sweden, covering an area of about five acres. The most northerly one was about 100 miles north of the Arctic Circle.

The experiments are being conducted with the co-operation of the Market Gardeners' Association, Farm Bureau, Department of Vegetable Gardeners of the New York State College of Agriculture, the Public Service Commission and the New York Power & Light Corporation.

▼

Westinghouse Lighting Studios in Cleveland

AS PART OF THE company's effort to bring the advantages of adequate and proper use of modern lighting equipment to industry and commerce, lighting studios have just been opened in the Cleveland works of the Westinghouse Electric & Manufacturing Company and are operated in conjunction with the photometric laboratories of the company, also just opened in Cleveland. The studios contain displays of exterior, interior and mobile color lighting and the latest developments in street, airport and all kinds of commercial and industrial lighting equipment.



In addition to the luminaires and other lighting devices, the latest systems of control equipment are displayed in actual operation, including resonant control, pilot-wire control (series and multiple), photo-electric-tube control, radiotron control, time switches and reactance dimmers. An experimental engineering department, outdoor and indoor lighting laboratories and photometric laboratories supplement the educational features.

In speaking of the new studios, L. A. S. Wood, head of the Westinghouse lighting sales section, said: "In the early days of lighting, before the art had been reduced to an exact science, little thought was given to the effect (illumination), and the cause (light source) was given undue prominence.

Modern illuminating engineering regards the resultant illumination and its quality as the criterion for judging the value of a lighting installation and the light source as something which might with advantage be subordinated or concealed entirely."

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Ontario Hydro Defends Its Quebec Purchases

RECENT CRITICISM directed at the Hydro-Electric Power Commission of Ontario for purchasing power from private sources has just been answered in a joint statement by members of the commission. "At no time," says the statement, "has the commission regarded the purchase of power as being contrary or inimical to the principles upon which the commission's program was originally based." The demand by Ontario citizens for from 75,000 hp. to 100,000 hp. more every year necessitated the purchase of power outside the province. Additional power could not be had at Niagara Falls, owing to the provisions of the international treaty, and the commission has had at no time authority to develop a share of the power available from the St. Lawrence River. "Faced with the necessity of providing large amounts of power either from steam or by purchase outside the province," the statement says, "the commission decided to purchase Canadian hydro-electric power from the sister province of Quebec."

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Aggresive Defense Is Urged at Ohio Meeting

ASSERTING THAT the time has come for the electric utilities aggressively to counter against the attacks made on them, W. A. Jones, president of the National Electric Light Association, advised the 800 in attendance at the East Central Division convention in Columbus, Ohio, this week to get ready for the fight. Mr. Jones said that in the face of the criticism leveled against it the industry owed to the elements of the foursquare base on which it rested—security owners, employees, customers and the general public—an unreserved accounting of its methods and policies so that the charges of ambitious politicians and of subverters of the American creed of individualism might be refuted.

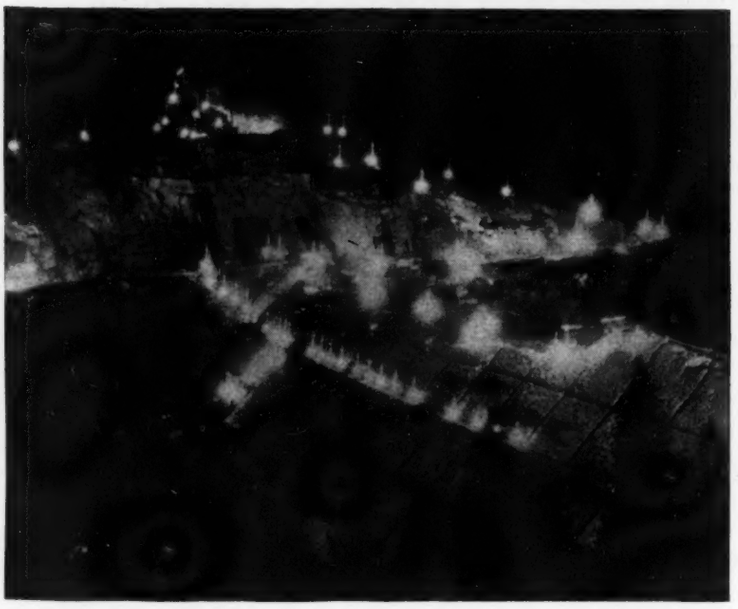
Much in line with these thoughts was a plea for the study and understanding of the fundamentals of business in relation to social polity recommended to utility men by Louis F. Musil, Cities Service Company. Speaking on budgeting as an essential of all stabilized progress, he said that budgeting goes deeper than the mere balancing of income and expenditure. It recognizes social forces, political trends, economic changes and, above all, human nature. Here utilities had fallen short.

Reassuring remarks on the business situation were made by F. P. Anderson, dean of engineering, University of Kentucky, and Paul S. Clapp, managing director N.E.L.A. Mr. Clapp presented statistics to show that the first four months of the year indicate a rising curve of electrical output from which encouragement as to the business trend may be drawn.

A well-rounded program dealt with rural service, treated by W. F. McCaskey, Middle West Utilities Company, and G. W. Kable, College Park, Md.; psychology in advertising and in employee relations, by A. C. Watson, Marietta College, and H. E. Bart, Ohio State University; metallurgy in steam-plant development, by A. E. White, University of Michigan; modernizing watt-hour meters, by W. F. Howe, General Electric Company; accident prevention, foreign-system co-ordination and other topics.

New officers are: President, C. L. Proctor, Toledo Edison Company; vice-presidents, G. E. Miller, Cleveland Electric Illuminating Company; C. E. Torrey, Ohio Power Company, and L. H. Tigha, Ohio Edison Company.

NIGHT VIEW OF P. G. & E.'S SALT SPRINGS DAM



On the upper reaches of the Mokelumne River, Calif., this massive hydro-electric dam, containing 3,000,000 cu.yd. of granite rock, is scheduled for completion in June of this year. It will be 330 ft. high, 900 ft. thick at the base, 15 ft. at the top and will have a crest length of 1,300 ft. Four contemplated power houses will have an installed capacity of 228,000 hp.

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California Edison's Case as to Severance Damage

AMPUTATION OF A PORTION of the system of the Southern California Edison Company will adversely affect the entire system of the public utility, B. F. Woodward, assistant general counsel for the company, testified before State Railroad Commissioner Seavey at Los Angeles at the hearing already briefly reported. Mr. Woodward made the assertion in testifying as to the compensation asked from the city for Edison company properties in Venice, Santa Monica Canyon, Watts, Green Meadows, Buckler, Tuna Canyon and Mar Vista, districts annexed to the city. Mr. Woodward pointed out that the company's whole system is operated as a complete economic unit and that, by reason of the diversity of load and operating conditions in its various districts, consumers in every portion of its territory are benefited by the fact that, directly or indirectly, the lines and power houses, substations and general organization forces are also serving consumers in other territories.

Dr. George L. Hoxie, economist and consulting engineer of the company, followed Mr. Woodward on the stand, put the fair value of the properties involved, including severance damages, at $6,145,000. The severance damage alone he estimated as $3,596,600.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Government Plant to Distribute Power

In connection with the new central steam-heating plant of the federal government at Washington, for which a contract has been let to the United Engineers & Constructors, an electric substation will be built to distribute power purchased from the Potomac Edison Company. The public buildings which will be supplied will consume approximately 34,000,000 kw.-hr. in an average year with a maximum demand of 18,000 kw. Future extensions will increase these demands by about 36 per cent.

Court Halts Municipal Plant

Completion of a municipally owned electric light and ice plant at Tecumseh, Okla., has been prevented by the Oklahoma Supreme Court, which holds that the contract entered into by Tecumseh for purchase of equipment, to be paid for out of revenues without creating a general obligation against the taxpayers, violates the state constitution. Tecumseh now owns its electric distribution system and purchases energy from the Oklahoma Gas & Electric Company.

Klamath Development in California

Application has been filed by the California-Oregon Power Company with the California Division of Water Resources for permission to divert 3,000 sec.-ft. of water from the Klamath River for the purpose of developing power amounting to 54,545 hp., at an estimated cost of $4,500,000.

More Rain Helps Southern Hydro Plants

Heavy rains during the last three weeks have rapidly increased the depleted storage of most of the hydro developments in the Southeastern States. In Tennessee and Alabama conditions are approaching normal for this season of the year. Ponds in Georgia, the Carolinas and Virginia are filling at a rate that seemed unlikely a short time ago. Some steam plants have been shut down owing to the increased water resources.

Valuations Ordered and Sought in Missouri

Notwithstanding the fact that long-drawn-out proceedings affecting proposed rates of the Union Electric Light & Power Company of St. Louis are now awaiting final argument before the Missouri Public Service Commission, that body has ordered a valuation of the property of the company named and two subsidiaries, the Cupples Station Light, Heat & Power Company and the St. Charles Electric Light & Power Company. Appraisal and inventory would probably take two years. The Mayor and City Council of Sedalia have petitioned the commission to order a revaluation of the City Light & Traction Company, a Doherty property, on the ground that property not used for operation is included in the present rate base.

To Complete Rogue River Plant

The Byllesby Engineering & Management Corporation announces that plans are being made for the completion of the Prospect hydro-electric project of the California-Oregon Power Company on the Rogue River in southern Oregon. Two units of 16,000 kw. each were placed in service at this plant in January, 1928, and it was then announced that a third unit of the same size would eventually be installed.

Tacoma Persists in Merchandising

By unanimous vote the Tacoma (Wash.) City Council has refused to discontinue the sale and servicing of electric ranges and other appliances, with an understanding that if an audit of city accounts now under way discloses that the city is losing money by this line of activity, the matter shall be reopened. The question had been raised by petition of retail merchants, wholesalers, the Chamber of Commerce and others seeking to get the city out of the merchandising business.

Fond du Lac-Janesville 132-Kv. Line

Work has been started by the Wisconsin Power & Light Company on a 132-kv. transmission line from Fond du Lac to Janesville, 108 miles. It will connect with the 132-kv. Fond du Lac-Plymouth-Sheboygan line, built in 1929 and 1930, which terminates at the generating plant now under construction at Sheboygan.

Five Kansas Companies Cut Rates

Five more reductions in light and power tariffs have been made, subject to the approval of the Public Service Commission, by Kansas companies. The Garden City Irrigation Power Company announced certain reductions of 20 and 40 per cent; the Kansas Power & Light Company certain reductions of from 25 to 54 per cent; the Inland Utilities Company reductions at Havana ranging from 14 to 26 per cent; the Sedan Electric Light & Power Company reductions of 15 to 50 per cent to larger users, and the Kansas Power Company reductions aggregating 23 per cent at Liberal.

CANADA

Fifth Hydro Plant for the Kootenay

The West Kootenay Power & Light Company has made formal application for its fifth power site on the Kootenay River in southeastern British Columbia. It is planned to develop about 30,000 hp. on a site opposite Brilliant, B. C. The five plants will be unique in Canada in that they will control the entire flow of a great stream.

Cape Breton Property Sold

F. B. McCurdy of Halifax and a group of Montreal capitalists were successful bidders recently for the properties of the Cape Breton Electric Company of Sydney, N. S., formerly under the executive direction of Stone & Webster. Their bid was $880,000.

ABROAD

Russia Has Stout Prophets

According to an Associated Press dispatch, G. I. Lomoff, described as president of a Russian committee to further a new ten-year electric plan, told a conference of electrical engineers at Moscow that the total generating capacity of 1,750,000 kw. aimed at in the first ten-year plan as fathered by Lenin had been attained. He went on to predict that by the end of the coming decade Russia will have 60,000,000 kw. or 70,000,000 kw. in service, surpassing the United States. He admitted small success up to the present in electrifying agriculture.

Edison Bust Unveiled at Munich

A marble bust of Thomas A. Edison was unveiled last week in the hall of fame of the German Museum in Munich beside that of Werner von Siemens. H. H. Barnes, New York, represented the Edison Pioneers and the American Institute of Electrical Engineers, which together donated the bust. He read a letter from Mr. Edison.

Coming Meetings

National Electrical Manufacturers' Association — Hot Springs, Va., May 18-23. A. W. Berresford, 420 Lexington Ave., New York.

Middle West Division and Nebraska Division, N.E.L.A.—Excelsior Springs, Mo., May 20-22. Thorne Browne, 1527 Sharp Bldg., Lincoln, Neb.

National Electrical Credit Association—Hotel Pennsylvania, New York, May 21 and 22. F. P. Vose, 1008 Marquette Bldg., Chicago.

National Electrical Wholesalers' Association—Hot Springs, Va., May 27-30. E. Donald Tolles, 165 Broadway, New York.

Wisconsin Utilities Association — Accounting Section, Racine, May 28-29. J. N. Cadby, 135 W. Wells St., Milwaukee.

National Electric Light Association—Atlantic City, June 8-12. A. J. Marshall, 420 Lexington Ave., New York.

Public Utilities Advertising Association—New York, June 14-16. Room 1748, 4 Irving Place, New York.

Association of Iron and Steel Electrical Engineers — Cleveland, June 15-19, J. F. Kelly, Empire Bldg., Pittsburgh.

Canadian Electrical Association—Banff Springs Hotel, Banff, Alberta, June 16-18. H. M. Lyster, 407 Power Bldg., Montreal.

American Institute of Electrical Engineers — Summer convention, Asheville, N. C., June 22-26; Pacific Coast Division, Lake Tahoe, Calif., Aug. 25-28. F. L. Hutchinson, 33 W. 39th St., New York.

Pacific Coast Section, N.E.L.A.—Del Monte, Calif., June 24-27. K. I. Dazey, 447 Sutter St., San Francisco.

Thomas Nesbitt McCarter

IN 1903 Thomas N. McCarter, Attorney-General of the State of New Jersey, resigned both that post and the office of general counsel of the Fidelity Trust Company of Newark, offices which he had held less than two years, to accept the presidency of the newly formed Public Service Corporation of New Jersey, the organization of which was largely due to him. Since then he has devoted his abounding energy and his executive ability to the further growth and strengthening of this great state-wide utility company with its three departments—electric light and power, electric and bus transit, and gas—and he is still the president both of it and of its constituent companies.

One accomplishment among many under Mr. McCarter's presidency has been the building of the Kearny generating station with a present rating of 214,500 kw., to be increased next year to 309,500 kw. and eventually to be still larger; another accomplishment was the formation in 1924 of the Public Service Electric & Gas Company to consolidate the various properties of the parent company embraced in that corporate name, and a third has been the building with the Philadelphia Electric Company and the Pennsylvania Power & Light Company of a 220-kv. interconnected transmission system to operate in the triple territory. Last year the Charles A. Coffin annual award to a light and power company of outstanding accomplishment and high aims of public service went to the Public Service Electric & Gas Company.

Mr. McCarter was born in Newark on October 20, 1867. He received his early education at the Newark Academy, was prepared for college at Dr. Pingry's school at Elizabeth, was graduated from Princeton in the class of 1888 and later attended Columbia University Law School. In 1891 he became a member of the law firm of McCarter, Williamson & McCarter, of which his father was the senior partner. Later he practiced alone. He early took an interest in politics, and Governor John W. Griggs in 1896 appointed him judge of the First District Court in the city of Newark. In 1899 Mr. McCarter resigned from the bench, and in the fall of that year he was elected to the State Senate from Essex County. He served as leader of the majority in the Senate and in 1901 was made chairman of the Republican state executive committee. In April, 1902, he was appointed Attorney-General of the state by Governor Franklin Murphy, from which post he resigned in 1903 to head the company of which he is now president.

Mr. McCarter served as president of the American Electric Railway Association for the year 1911-1912. He is now a member of its advisory board, of the public policy committee of the National Electric Light Association and of the advisory council of the American Gas Association.

EDITORIALS

L.W.W.MORROW
Editor

England to electrify all rails as a way out?

IMPATIENT with continued trade depression and embarrassed by unemployment problems, Great Britain may eagerly welcome the bold suggestion of Lord Weir's committee on railroad electrification. That the economics of the situation may have been hastily evaluated, however, or even subordinated to the prospect of giving sixty thousand men continuous employment for fifteen or twenty years, is at least open to argument.

No piecemeal program is advocated in the report of this committee, appointed in 1929 by the Labor party government. On the contrary, a single comprehensive scheme for complete railroad electrification is sponsored at an estimated cost of two billion dollars, including railroad expenditures and additions to power stations and systems. The average over-all return on railroad expenditures is estimated at 7 per cent. Energy would be sold directly by the Central Electricity Board to the railroads at the probable figure of 1 cent a kilowatt-hour. This project would mean that 49,700 miles of single-track line would be converted from steam operation. Electrified lines in Great Britain total today about 1,300 miles.

Such a scheme must or should be dependent upon analytical data of all but unquestionable reliability. To hurl a country suffering from economic difficulties such as Britain has faced for many years into a two-billion-dollar electrification program which could not be self-supporting as regards the capital required, only to have it revert ultimately to a status demanding another increment of taxation, would be folly beyond all conscience—folly for Britain and folly for the cause of electrification. If the basic data, upon examination by railroad, banking and economic authorities, prove logical and reasonable, there should, on the other hand, be no reason for hesitancy. In that case a courageous, bold and unprecedented step for the self-help of a people in distress would vindicate itself.

Roosevelt shows his colors

AT LAST the trustees for the development of St. Lawrence power have been appointed by Governor Roosevelt. This complex and enormous task has been placed in the hands of an inexpert "Power Authority" with known radicals in the majority. The two radical members of the legislative commission which investigated the laws of New York governing utility regulation and wrote the minority report of this commission are among the appointees, but no member has been named from the St. Lawrence Power Development Commission, on whose report, unanimous save for one dissenter, the law creating the new State Power Authority was based. Why were not one or more of these men, whose work won praise on all sides, or of their engineering consultants, appointed? Does the Governor still view their conclusions with suspicion?

And the only engineer—not an electrical but a "consulting management" engineer — to be appointed as a trustee is celebrated as the right hand of Governor Pinchot of Pennsylvania on utility matters. He was a leader in the great fanfare about mouth-of-mine power plants for Pennsylvania that proved so fallacious economically. He is noted for his anti-utility attitude. Why was it necessary to go to Pennsylvania for an engineer? Will Pinchot support help Roosevelt gain votes?

What hopes are there of any well-ordered and intelligent carrying out of the St. Lawrence plan with these inexperienced or radical trustees in control? Why was not a group of experienced

business men and engineers appointed? Surely this is but another example of political statesmanship. Business and politics do not mix when a state governor becomes ambitious and reaches for the presidency.

Detecting faults in oil-circuit-breaker insulation

SERVICE continuity has become so important today in electric transmission that new methods of locating weaknesses in insulation are of great interest to operating engineers and indeed cannot be safely overlooked in high-grade practice. Recently the electrical apparatus committee of the New England Division, N.E.L.A., held a meeting at Harvard University to discuss the Doble method of testing insulation conditions in bushings and oil circuit breakers. This method gages these conditions in terms of power factor, and it has now had field application to more than 14,000 units with results of compelling interest. From the testimony of Professors Adams and Dawes in regard to the accuracy of this method and from the experience of operating engineers like C. T. Hughes, E. S. Bundy and C. R. Reid regarding its usefulness as presented on this occasion, it appears that a distinct advance has been achieved in the technique of the art.

It is highly significant that in the 14,000 bushing tests mentioned more than 50 per cent of the faults whose presence was revealed had nothing to do with the main insulation of the bushings but arose from other conditions in the breaker. Of 3,715 bushings tested, 2.6 per cent disclosed faults, and of these 1 per cent were in the bushings and 1.6 per cent in external leakage paths. Professor Adams emphasized the value of being able to utilize this method analytically, with the breaker closed or open, with the oil dropped and with other combinations enabling the operating engineer to search out and locate the source of trouble.

Manufacturing engineers who spoke at Cambridge voiced a more conservative attitude toward power factor as a measure of bushing insulation quality than did the operating engineers. Long reliance upon the "megger," with its maximum portability and nominal cost of application, has built up a good deal of confidence in this device. Messrs. Powel and Eby questioned whether as yet power-factor values have attained full standing as quality yardsticks in the measurement of internal insulating conditions in breakers. Among operating engineers, however, the opinion was generally expressed that the "megger" method has limitations as a measuring device for hitherto obscure insulation maladies, and the receptive attitude evidenced toward the new method and interest in the results of its increasing use at least indicate a healthy state of mind in power-transmission circles. The addition of power factor to resistance measurements tends in the long run to bring about closer control of factors which are of tremendous importance from the standpoint of both economics and public relations.

Electric water heating

SEVERAL years ago the attitude of the utility executive was expressed by the question "Can electric domestic water heating ever be done on a practicable basis?" Today the question is, "What is the best method of electric water heating for my company to adopt?" The effort to answer the latter question has brought forth so many suggested systems that progress in building this load is actually being delayed. A long step toward bringing order out of the confusion is made by C. P. Randolph and F. H. McCormick in the article published in this issue of the ELECTRICAL WORLD analyzing the effect of various types of water heaters on a typical residential load including an electric range.

The data for the analysis are derived from laboratory investigations, but the authors do not contend that such tests have the value of field studies which reflect the diversified habits of home life and obviously are necessary accurately to ascertain group load demands. They do contend that for comparing the different systems of electric water heating as regards the service given to an individual customer in terms of energy consumption, quality of hot-water service, size of tank required and connected load, laboratory tests are more reliable than field studies because all conditions are known and held constant for accurate comparison. The authors show that, like all engineering problems that have been subjected to

thorough analysis, the solution is a sound compromise between all the desired characteristics.

Almost every central-station executive, if the sister utility of gas service does not claim a share of his allegiance, will admit that electric water heating is a desirable load. Although this article does not venture into the realm of costs to either the system or the customer, it does supply operating and performance data in the light of which the economic aspects of the subject may be considered in any particular case. Having this information, the executive has no reason for continued holding off, but should start his commercial men full speed in the development of this class of load.

For the next "new economic era"

IN THE days of long factory hours and hand labor the plant investment was relatively small and its utilization high. Poor lighting hampered night operation. But times have changed. Mechanization has enormously increased plant investment, but single-shift working utilizes barely 30 per cent of the hours on which this investment must earn its carrying costs.

Double, or even triple, shifts would proportionately reduce the plant cost per unit of product. Some industries have found long-hour use practicable without perpetuating those evils of night work which an enlightened social conscience properly condemns. In other words, the change can, of course, come about only as new industrial plants are designed and put into operation, rated in terms of full-time production.

How would such a program affect electrical manufacturing? By hastening obsolescence it would facilitate the introduction of modern devices. If a motor is good for twenty-five years when working 30 per cent of the time, its useful life is seven and one-half years if operated continuously or nearly so. The same reasoning applies to the rest of the factory. Modernization would be not only automatic but almost inevitable.

For the central station the improvement in load factor would be conspicuous. Contrast these two conditions: The kilowatt-hour output of electric light and power plants in the United States in 1930 represented about 30 per cent of capacity operation. Meanwhile, a certain Eastern power company operates month after month at a load factor around 80 per cent. Why? It has a big paper-mill load. Paper making is a continuous process. Essentially the same result would come from any other twenty-four-hour industrial load.

Interconnection control— automatic and human

TWO kinds of stability must be sought and attained in the operation of connections between electrical systems. One is concerned with operation, is a matter purely of lines and equipment; the other has to do with the stability of relations between the men who operate them. The stability of human relations between the men in the connected systems reflects the normal and abnormal conditions existing on the lines and in the stations.

Conductors may be heavy enough and well enough protected and equipment may be sturdy enough to insure perfect electrical stability, and still John Doe of the X system will think that Richard Roe of the Y system is a poor operator, while Richard strongly feels that John is trying to take selfish advantages. The reason for this state of mutual misunderstanding is that human beings differ and it is easy and even traditional for each system to operate as it has always operated. Generally the load happenings that arouse ire at one end or the other are inadvertent, but sometimes they are deliberate.

One way to bring accord between operators of interconnected systems is through the removal of human judgment from its place as a factor in their operation. It appears that that way is being opened by the development of automatic frequency and load-control equipment. This development should be heartily encouraged as a means for the lowering of blood pressures and for relieving strain on tempers. It can be assisted by reports from users of "try-out" and experimental equipment, and they should not be backward about relating their experiences in committee meetings and reports and in the technical press. Another way is to exercise forbearance and to educate operators so that an intersystem understanding will be established and personal friendship cemented.

Club House Electrical System

Provides Adequate Wiring for Special Events

Interlocking of lights and ventilation.

Multiplicity of outlets for electric service, radio, signal and communication systems.

Facilities for future service demands, reliability and safety.

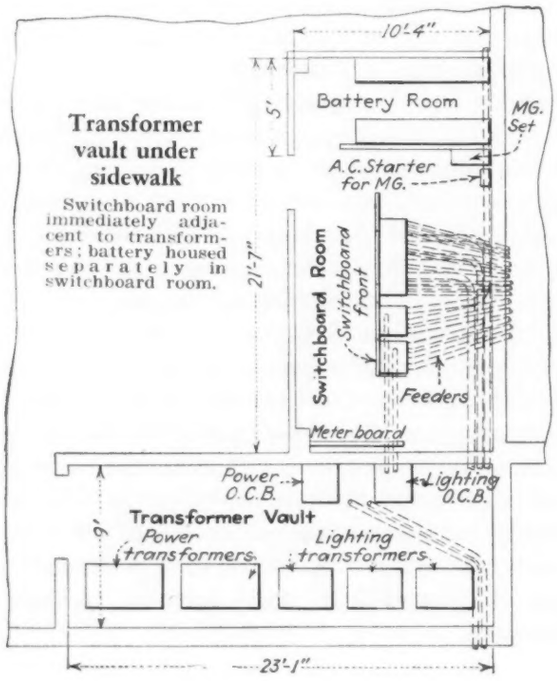
By A. P. SEELEY

Electrical Engineer, Westcott & Mapes, Inc., New Haven, Conn., and New York City

ESSENTIALS of an electrical installation for a large club house are very similar to those of a hotel. The points of departure are principally due to the fact that virtually all of the occupants of the club are part owners through their club membership. Their desire to see new schemes and devices incorporated as they come with progress of the art is likely to be more prompt than in the case of a hotel. In the case of the club house, therefore, the service facilities should be more detailed, more elaborate, more flexible and more complete in their anticipation of possible requirements than in the case of the average hotel.

Some features of the electrical system contemplated for a 22-story athletic club house having a volume of approximately 2,000,000 cu.ft. and a floor area of about 170,000 sq.ft. are illustrated in the accompanying drawings.

Wire sizes should be designed to carry the peak loads and maintain proper voltage at the consuming devices for these loads. One electric circuit operating at a normal full-load capacity is better economy than a number of circuits operating at one-quarter, one-half or two-thirds full load to accomplish the same result. Main supply feeders should be connected at points where they will reduce the outage area in the building to a minimum in case of feeder trouble. Feeders should be kept to standard wire sizes and loads assigned to them in as uniform manner as possible. Emergency feeders should be installed as spares so that elevator service may be maintained.

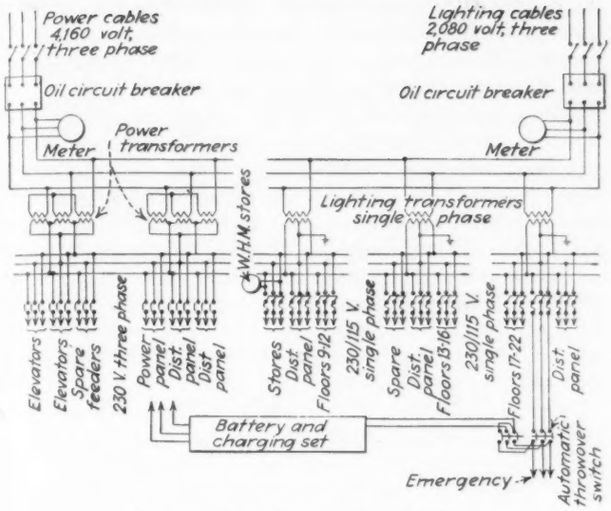


National recognized standards of electrical design in the matters of illumination, voltage drop, wire sizes, number of outlets per circuit, watts per circuit, motor wiring, etc., should be most strictly adhered to. Local code requirements often make necessary increased labor and material costs. Limitation of circuits to 660 or 750 watts excludes perfectly safe installations in fireproof buildings to meet the requirements at a reasonable cost. Trouble from inefficient service and fire hazards can be reduced to a minimum with the selection of good grades of materials and with good workmanship.

The number of light and power panelboards should be carefully studied where future possibilities indicate increase or decrease of load. Distribution cabinets should be eliminated where possible. Cost can be reduced by choosing economical locations with respect to branch wiring. The size and number of circuits are of further importance.

Benefits of co-operation in layout

An economical and efficient electrical system can be obtained, especially if the owner, the architect and the electrical engineer will participate and co-operate from the very first preliminary design and layout. In this manner can building space be conserved and future needs predetermined with regard to service entrance transformer vault, switchboard room, feeder runs, risers, riser closets, panelboard locations, outlet locations, signal equipment rooms, signal conduit and wiring, and so on.



Incoming and outgoing feeders

Battery-charging set provided with reverse-current relays to prevent battery drain

This is a very important factor in the electrical design, and if followed through intelligently it will produce the best over-all results.

With these matters duly accomplished, simplicity, reliability, safety, economy and reduced costs will be attained. All future growth can be provided for in the original plans. The service transformers, switchboards, panelboards, feeders and branch circuits can be designed for the various peak loads expected and properly estimated. Thus ultimate cost can be kept to a minimum even though the first cost is slightly increased.

Electrical equipment of a better grade should be installed rather than something of an inferior grade that just comes within the rulings of a code. Safety and quality should not be sacrificed for dollars.

For large club houses the following general features are of importance:

Two separate sources of service supply to the building should be obtained if possible from the power company's system. One of these sources should supply normal service and the other emergency service. Normal service may consist of one lighting and one power feeder cable and the emergency service obtained from an emergency feeder cable for emergency light and power demands. In any case switching provisions with an arrangement for emergency service connections should be installed.

The transformer vault containing the transformers, high-voltage switching equipment, wiring, etc., should be installed at a central point with respect to the electrical load center in the building. Operating handles from manually operated oil circuit breakers may extend through the vault wall into an adjacent switchboard room. Natural air ventilation, independent of all other ventilating systems, should be provided. The vault should be easily accessible both for equipment and for inspection.

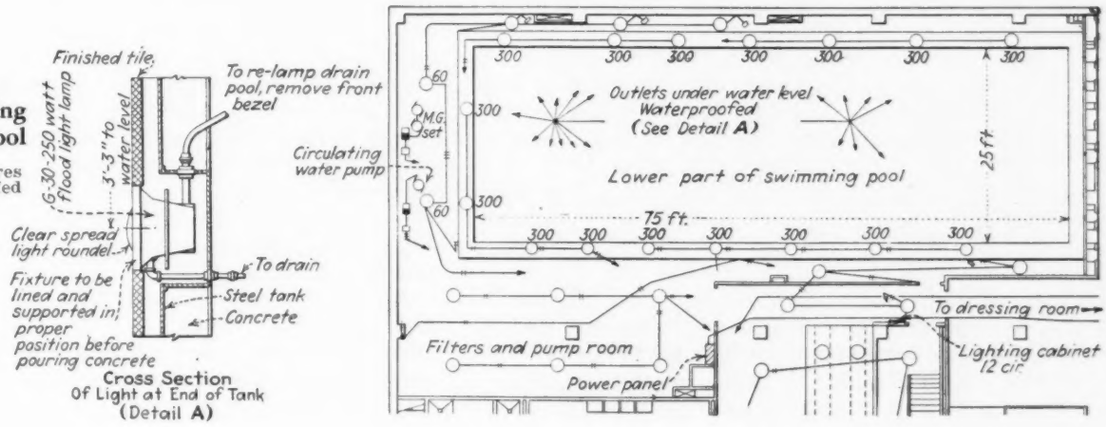
Locations conducive to short runs

Locating the switchboard room adjacent to the transformer vault will facilitate short secondary wiring from the transformers to the switchboard. Likewise, the location of this room close to the building riser shafts will allow short feeder runs from the switchboard. The power company's service board with watt-hour meters may be mounted in the switchboard room near the oil-circuit-breaker operating rods mentioned above. The switchboard may be sectionalized for both light and power with each transformer connecting to a respective section, thus reducing service interruptions. Each bus section properly loaded will maintain balanced phase conditions with respect to total load. Metering on the low-tension side may be omitted except for store tenants. The switchboard may consist of panels containing air circuit breakers for the power feeders and knife-blade switches with refillable fuses for the lighting feeders. Fuses may be mounted on fuse blocks in the rear of the switchboard panels. The switchboard may be of the live-front type because of its isolation in a separate room. Sufficient space should be provided all around the switchboard. Rubber mats should completely cover the floor at the front and rear of the switchboard for its full length and also in front of the power company's service board. Mats should be of proper size so as to leave no space between them. A special panel for emergency service may be installed as a part of the main switchboard.

Alternating-current lighting feeders (230/115 volts, three-phase, to two-wire, single-phase, grounded neutral), not larger than 500,000 circ.mil, with maximum loading, are satisfactory for lighting distribution. Varnished-cambric insulation (600 volts) may be used. On the riser runs varnished-cambric cables may be provided with a slipper compound of such consistency that when a

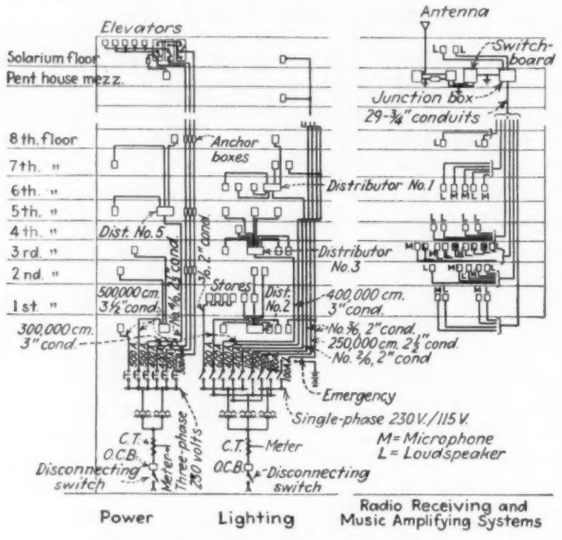
Side-wall lighting of swimming pool

Submerged fixtures set in waterproofed recesses.


Finished tile
To re-lamp drain pool, remove front bezel
G-30-250 watt flood light lamp
3'-3" to water level
Clear spread light roundel
To drain
Fixture to be lined and supported in proper position before pouring concrete
Steel tank
Concrete
Cross Section Of Light at End of Tank (Detail A)
Circulating water pump
M.G. set
Outlets under water level Waterproofed (See Detail A)
Lower part of swimming pool
75 ft.
25 ft.
To dressing room
Filters and pump room
Power panel
Lighting cabinet 12 cir.

sample of the cable one foot long is suspended vertically and subjected to a temperature of 95 deg. C. for one-half hour there will be no appreciable loss of compound while at that temperature.

Power feeders (230 volts, three-wire, three-phase) and risers, similar to lighting feeders, may be installed and varnished-cambric 600-volt insulation used for specific power-load service with breaker and switch sizes in accordance. Feeders for elevator service should be arranged for a minimum of service interruption. This may necessitate one or more spare feeders, depending upon the number and importance of the elevators in-



Extensive radio and music systems

Boxing, squash exhibitions, orchestra music and outside programs provided for by means of appropriately located microphones and loud speakers.

stalled. Switches to emergency feeders may be installed at the switchboard or in the elevator penthouse. Feeders should carry peak-load demands safely and economically.

As an extra precaution for a possible varnished-cambric-feeder insulation failure, light and power conduits may be installed oversize, so as to accommodate rubber-covered double-braid cables. This arrangement will allow varnished cambric cables to be withdrawn, if found necessary, and rubber-covered double-braid cables to be installed of equivalent carrying capacity.

Panelboards installed one or more on a floor are most convenient. Where they cannot be locked up in closets, the door-within-a-door type may be specified to prevent unauthorized persons from coming in contact with live bus parts and from changing fuses. Distribution panels may be satisfactory where loads are exceptionally large. The concentration of loads or the formation of load centers in the building should be most carefully designed.

In large club houses there will be about 80 or more motors, ranging in size from ¼ hp. to 40 hp. The motor load will approximate 500 hp. Most of the motors will be of 5 hp. or less. The larger sizes will include elevators, house service and fire pumps and motors for the larger pieces of mechanical equipment. The smaller sizes will take care of ventilation, refrigeration, laundry, print shop and kitchen equipment. All motors of ¼ hp. or more are usually 220 volts, three phase, 60 cycles.

Heating appliances in the form of electric ovens should be supplied with three-phase power circuits. Smaller devices, such as toasters, waffle and griddle irons, may be operated at 220 volts, single phase. Electric circuits for heating must be carefully figured and laid out.

The minimum level of lighting of all rooms should be figured for standard and recognized foot-candle intensities and wattage determined therefrom. Higher intensities are used for lighting special exhibition courts for handball and squash tennis. Indirect lighting fixtures provided with auxiliary lighting behind decorative glass mounted below the opaque reflector of the main unit will produce a pleasing illumination in the main corridors and lobbies. Some club houses still use large chandeliers with wall fixtures in the dining rooms, grill rooms and lounges, but the most beautiful illumination and lighting effects are obtained from totally indirect and concealed light sources on the ceiling and walls. Auxiliary illumination, when carefully installed, can materially add further pleasing and useful results. This may be obtained by means of many plug receptacles furnished throughout the building for mantelpieces, illuminated wall paintings, fireplace effects, signs, floor lamps and special lighting for the Christmas season.

Generous lighting for gymnasium and pool

In the gymnasium direct lighting of high intensity close to the ceiling is satisfactory. A special ceiling outlet for a portable boxing-ring lighting fixture is necessary. A special floor outlet for microphone, telephone and telegraph connections for ringside broadcasting and news service is also required. Standard outlets are necessary for motion-picture equipment. Thirty-ampere plug receptacles with pilot bull's-eye light can be provided in the balconies for connection of portable spotlights.

The lighting for the swimming-pool room can be obtained through a diffusing plate-glass ceiling over the pool area. A pleasing "sky effect" from the pool is produced by 300-watt lighting units with prismatic glass reflectors so arranged as to spread the lighting uniformly over the entire glass area. Provision can be made for color control and decorative effects. No bracket or pendent lighting fixtures should be used. Under-water lights for the swimming pool should be installed around the side walls of the tank.

Ventilation for handball and squash tennis courts can be arranged to be automatically controlled by the lighting in the courts. A constant-speed motor-control scheme is electrically interlocked with the lighting system in the courts, so that when the lights in the courts are turned on the fans for ventilating the courts will be automatically started. Ventilating fans consist of both supply and exhaust fans rated at ¾ hp. each. A triple-pole, double-throw switch in the fan room near the motor starter is used to disconnect the control from the lighting switch in the court and connect it to the usual control for testing purposes. Ventilating systems common to two or more courts are connected so that the light switches will operate the system. Standard equipment may be used throughout.

Emergency lighting outlets at all exits, stairways, corridors, exit passageways, fire escapes and special rooms must be provided. A decorative design for illuminated signs in the main corridors and lobbies may indicate the direction of exits. The emergency lighting

system is normally operated on the main lighting service supply and arranged with an automatic throw-over switch to the emergency source of supply in case the main lighting service fails. The emergency lighting system is best isolated in a separate conduit system with separate panelboard control. The emergency supply source may consist of a storage battery, motor-generator charging equipment, charging panel, feeder switch and automatic throw-over switch. The battery capacity should supply the full emergency lighting load at normal voltage for at least one to two hours. The charging control may be mounted on the main switchboard on a separate panel. Charging may be non-automatic and require the usual maintenance by an authorized attendant.

Voltage drop and the wire sizes

Voltage drop on 110-volt lighting circuits should not be more than a 3-volt total maximum drop, comprising one volt on the branch circuit, two-thirds of a volt on the main circuit and one and one-third volts on the feeder. Voltage drop on 220-volt power circuits for motors may be 5 per cent, or 11 volts maximum drop.

Branch wiring for lighting ranges from No. 6 B. & S. gage to No. 12 B. & S. gage. In many cases No. 14 B. & S. gage is too small. Plug receptacle circuits for medium duty up to 20 amp. may be served with two No. 12 B. & S. gage wires in ½-in. conduit. For heavier-duty circuits and for long runs larger wire and conduit must be used. Branch wiring for motors should follow standard code practice. Large motors may be placed on single circuits and smaller motors grouped on one circuit.

The estimated connected load for lighting for a 22-story club house may approximate a total of 352 kva. The estimated connected load for power may approximate a total of 700 kva., while the normal operating load may be estimated at approximately 50 per cent of this.

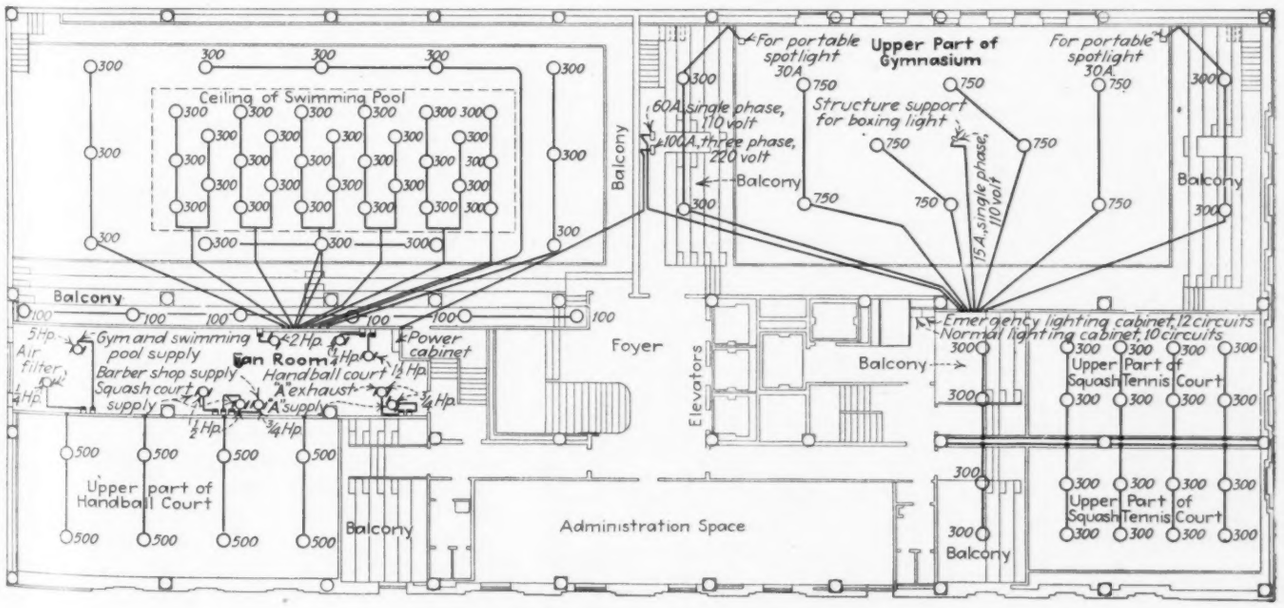
Public and private telephone booths should be located at convenient points on all important floors of the building. Pay-station booths connecting direct with the city exchange should also be included. Both telephone and telegraph service should be brought into the building to a special room or cable terminal room, which should contain the necessary terminal racks arranged for jumper cross-connections. The telephone installation should follow the general practice of the telephone company's standard recommendations.

The annunciator system connecting with dining rooms, pantries and kitchens should receive careful attention, especially in regard to the conduit layout. Transformers connecting with the lighting system furnish supply current. Other optional signal systems are the telautograph, teletype and stock-ticker service.

Clocks are needed in generous supply throughout the building. Styles and models should be selected to suit individual locations. A battery-operated system will give an uninterrupted service.

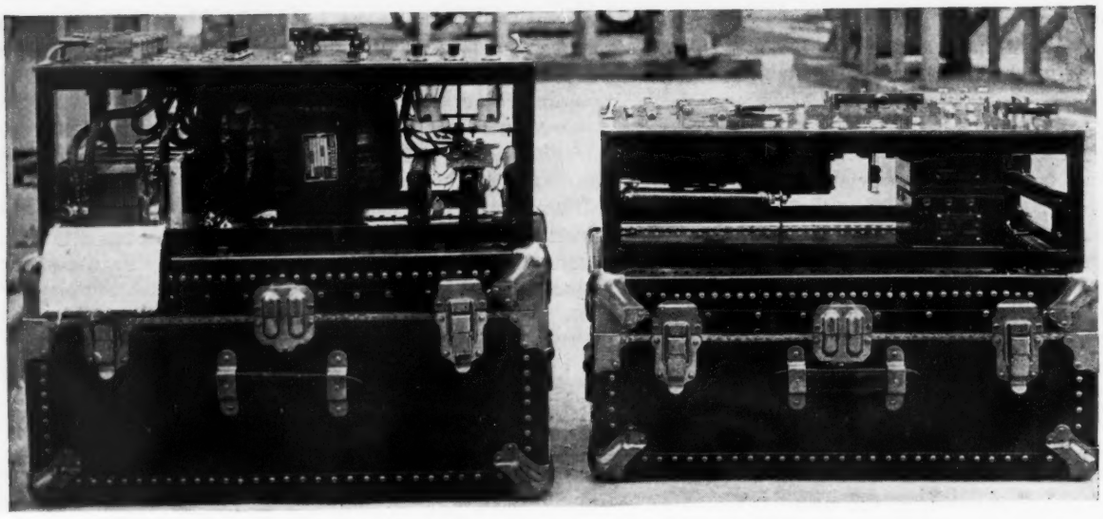
Fire-alarm and watchman's service may in some cases be combined in one conduit and served from the same battery. Some club houses are installing A.D.T. service, while others are using local fire-alarm systems, for the building only and not connected to the municipal system. Large bells are set in boxes with grill covers and recessed in the walls so as to be concealed from view. Coded alarms are first given on pre-alarm or pilot bells. The watchman's system may include both report and non-report stations with supervisory desk observation. The central desk may also make telephone connection to the various watchman's stations and *vice versa*.

For radio-receiving and music-amplifying systems a radio room on the top floor of the building may be provided. This room should contain the complete control for a combined system of radio reception and music amplifiers operating the same loud speakers for each service as required. Loud speakers in the various public rooms can be used for either radio reception from outside or musical programs from an orchestra in the building. If these systems are not wanted until a future time, cost may be reduced greatly by installing empty conduits for them.



Sky effect obtained for swimming-pool ceiling

Eight kilowatts of lighting units above diffusing-glass ceiling simulates outdoor effect for bathers in pool.



All that is needed for relay testing

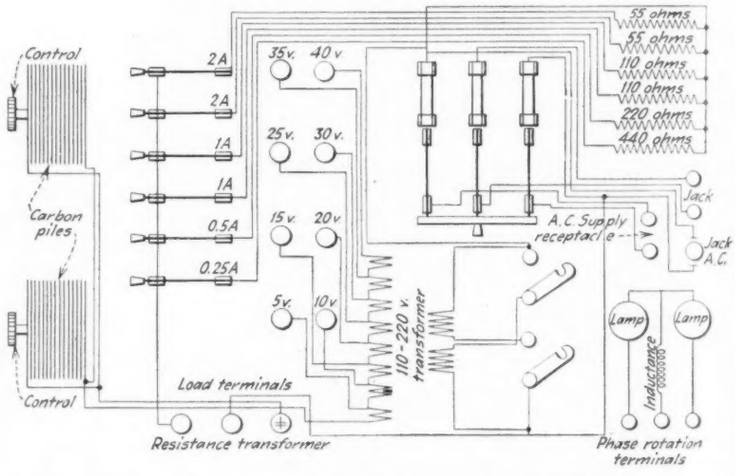
The mounting of transformers, instruments and other necessary equipment on welded angle iron frames makes a rigid assembly of parts that will stand the handling of routine testing.

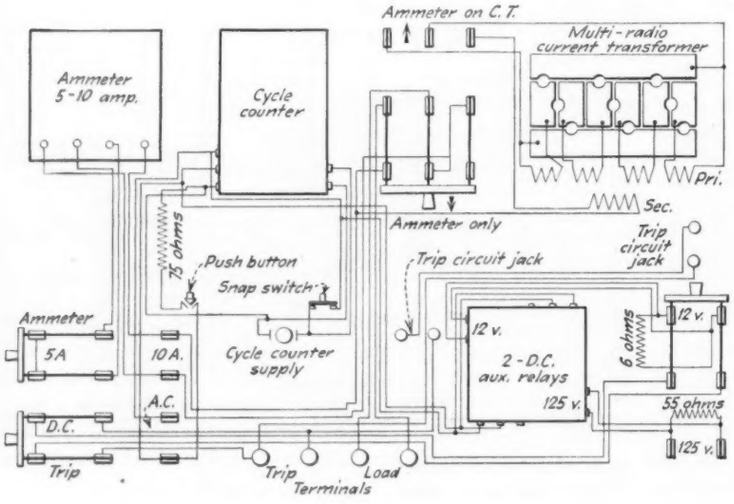
The Complete Relay Tester

By ORIEN A. PENDLETON

Foreman Meter and Relay Department, Empire District Electric Company, Joplin, Mo.

Routine and special testing of relays in their installed location may require the carrying about of many pieces of equipment, including instrument transformers, load boxes, resistances, etc., and may require also the use of time that could profitably be employed in actual testing in making and unmaking connections and set-ups. These difficulties of relay testings are eliminated on the system of the Empire District Electric Company through the use of a compact assembly into two carrying cases of the needed equipment. One case contains a special tapped transformer and its related devices for furnishing various current quantities. The second case contains the testing instruments. The cases were specially made of four-ply veneer with a covering of heavy fiber, reinforced at the corners and joints. The top panels of the assembly are ¼-in. micarta mounted on a welded angle iron framework, which by means of convenient handles



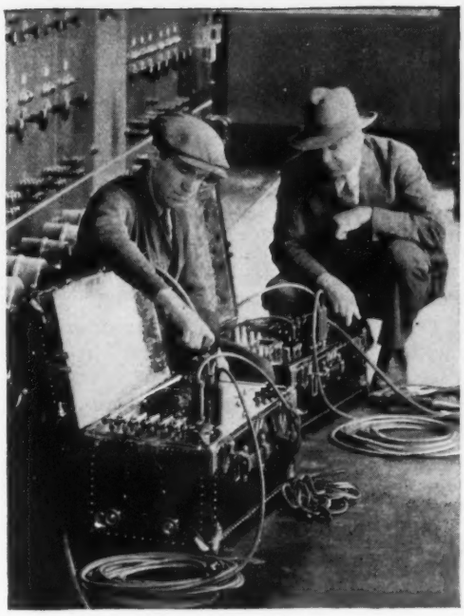


The connections are simple

The upper diagram shows the wiring layout in the transformer case assembly. The lower one shows the layout of the instrument case.

can be quickly removed from the cases, making all the equipment and wiring easily accessible. Wooden blocks in the corners of the lids of the cases hold the equipment rigid when the lids are closed. The transformer and instrument assemblies weigh approximately 175 and 75 lb. respectively. Tirex wire is used exclusively for external connecting leads.

The alternating-current supply is brought to the transformer case through a No. 8 double-conductor Tirex cable. Russell & Stoll heavy-duty plugs and receptacles are



The test set in use

Two men are required in making a test. Also two men are required to carry the equipment.

used on this cable. The supply is carried through a fused knife-blade switch either to the testing transformer or to a number of resistors. The resistors are used to secure smaller current than can be held constant with the carbon rheostats which are used on the secondary of the transformer. The secondary has taps brought out in 5-volt steps—up to 40 volts as an additional assistance in current control. Transformer case contains also an independent phase rotation meter consisting of two 10-watt lamps and an induction coil connected star. This meter is convenient for setting directional relays on three-phase circuits.

The instrument case contains an ammeter and a multiratio current transformer that combine to give 5 to 200 amp. full scale meter deflections in convenient steps. A cycle counter and two direct-current auxiliary relays are also in this case. The auxiliary relays are used to determine the actual operating time of oil circuit breakers. A snap switch is conveniently placed to take the cycle counter out of the circuit when adjusting the current to the relay under test. A push button operating across the line through a resistance is used for testing the condition of the auxiliary contactor switch and operation indicator.

Some of the features of this testing assembly are: (1) Accurate current quantities can be obtained from $\frac{1}{4}$ to 200 amp. on either 25- or 60-cycle, 110- to 220-volt circuits; (2) secondary voltages can be obtained in 5-volt steps 0 to 40; (3) phase rotation can be checked instantly; (4) timing of oil circuit breakers can be obtained with no additional equipment; (5) operation of auxiliary contactor switch and operation indicator can be tested by pushing a button.

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Supervisory Control for Oil Pumping

By W. C. DREYER and G. F. JONES

General Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The use of electrically driven pipe line pumps has proved economical in recent years because of lower first cost and decreased maintenance. The greatest advantage, the use of automatic pumping stations with supervisory control, has, until recently, been entirely overlooked. A number of pipe line operators have become aware of the possibilities of remote control and electric drive. One company is now making an installation of a station to be operated remotely by supervisory control to prove the dependability of this type of equipment.

Entirely dependable supervisory control, requiring but two telephone lines for complete control of a multiplicity of operations and giving visible indication at the sending station of the operations which have been performed, is available. Lights represent the valves and other controlled apparatus. Using visual supervisory control makes it possible to change operators at any time, the incoming operator being informed at a glance of the position of all apparatus in all stations under his control.

The greater investment required for remotely controlled pipe line stations is more than justified by the

Comparison of Costs Showing Saving Effected by Using Supervisory Control for Electric Pipe Line Pumping Stations

	Manual Control	Supervisory Control
Investment		
Motors and pumps installed in pump house complete less wiring and control		
Cost per station	$20,000	$20,000
Cost for nine stations	$180,000	$180,000
Wiring and control including control panels, starting transformer, station wiring, complete supervisory control, automatic safety features, and addition for motor-operated valves	22,000	150,000
Telephone lines for nine stations, using iron wire in each case and extra copper lines for supervisory	200,000	250,000
Operators' houses for nine stations	95,000	30,000
Water and sewerage systems	10,000	5,000
Total investment above	$507,000	$615,000
Fixed Charges (Annual)		
Taxes and insurance, 2 per cent	$10,140	$12,300
Interest, 6 per cent	30,420	36,900
Depreciation and parts, 10 per cent	50,700	61,500
Above annual fixed charges	$91,260	$110,700

	Manual Control	Supervisory Control
Operating Expense (Monthly)		
Operators for nine stations	$4,050	
Electricians and automobiles	1,100	$1,450
Telephone and telegraph maintenance	1,600	1,600
Dispatchers	750	750
Above monthly payroll	$7,500	$3,800
Above annual payroll	90,000	45,600
Annual fixed charges	91,250	110,700
Annual operating expenses	90,000	45,600
Annual power bill	275,000	275,000
Annual total charges	$456,260	$431,300
Summary		
Net saving in total annual charges as compared with manual control after 18 per cent carrying charges		$25,000
Added total investment over manual control		108,000
Clear profit on added investment after 18 per cent carrying charge, per cent		23
Gross saving in annual operating expense as compared with manual		$44,400
Added total investment over manual		108,000
Gross saving in annual operating expense in per cent of added investment, per cent		41

Conditions and Assumptions Made in Comparison of Oil Pumping Costs

A pipe line of nine stations.
Spacing of stations, 50 miles.
Two units operating and one stand-by per station.
200-hp., 3,450-r.p.m., three-phase, 60-cycle squirrel-cage motors.
Power cost averages 1.15 cents per kilowatt-hour at 2,300 volts.
Pipe line pressure 600 lb. per square inch.
Motor efficiency 93 per cent, power factor 91 per cent.
Motor output 190 hp. or 142 kw.
Using two units per station, these conditions indicate 29,000 bbl. pumped per day.
Power input per station, 305 kw. or 336 kva.
Power bill per month per station $2,520.
Power bill per year for nine stations, $274,000.
Pumps with motors installed in pump house complete, less control, less wiring, three units approximately, $20,000.
Operating labor considered does not include superintendents, office force, pipe liners, or any other not affected by electrical operation or by method of control.
Depreciation is taken at straight 10 per cent per year and includes obsolescence and repair parts.
Manual stations require three operators per station.
One telephone maintenance man is required for 100 miles of telephone line.

decreased operating costs. A typical pipe line was chosen and a comparison made between manual and supervisory control costs to determine the economies effected by the use of supervisory control. Another advantage of supervisory control pipe lines which should not be overlooked is centralization of control whereby the operator at the sending station maintains instantaneous and complete control of the entire line. Continuity of service is increased and greater protection against emergencies is afforded by central control. This is due primarily to the elimination of the human element and to the use of reliable, proved, protective devices.

The accompanying table shows the figures and conclusions reached in this comparison. Supervisory control will operate over a distance of 200 miles when using No. 8 B. & S. gage copper wire. The tabulation is therefore based on nine stations spaced 50 miles apart.

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Steam-End Instruments Meeting Wider Adoption

The number of boiler and turbine room instruments in use is increasing and their investment cost per kilowatt reflects a decrease in stations of increasing size. Checking, maintenance and other upkeep costs increase with the size of the unit to which they are applied, but also at decreasing costs per kilowatt. The investment cost of such instruments per kilowatt tends to decrease more rapidly than the upkeep cost per kilowatt. These conclusions are stated in a recent report (No. 19, January, 1931) of the N.E.L.A. prime movers committee.

A survey of the experience with the various instruments shows that the operation of condenser leakage indicators appears satisfactory. Boiler water level indicators are meeting increasing adoption for supervision of boiler water carryover. There is an apparent desire for an instrument to record directly the back pressure at a turbine exhaust nozzle. Automatic compensation for feedwater temperature fluctuations is preferred to manual adjustment of the air-flow pen on combustion control meters. Two types of moisture alarm are announced for generator air-cooling systems. Automatic coal sampling is reported to be more consistent than hand sampling.

The report suggests a plan to secure a gradual improvement in the satisfaction obtained from mechanical meters. It follows the methods of standardization which have brought electric meters to a high degree of homogeneity.

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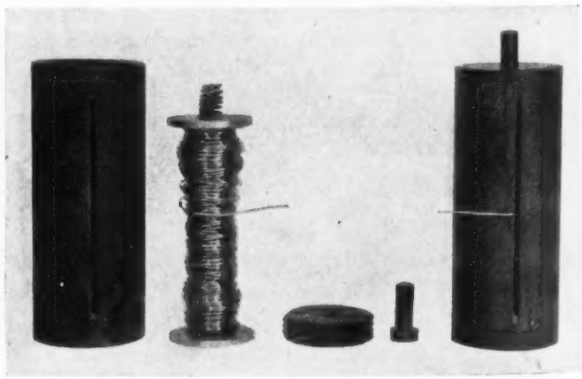
Cable Binding Wire Spooled to Increase Safety Factors

An insulated protective device for use in beading live cable with copper wire has been developed by the cable bureau of the United Electric Light & Power Company, New York. This conductor binding wire spool has, for the cable worker, not only protective features but mechanical advantages as well, since it facilitates the joining of desired additional service to live cable.

As indicated in the accompanying illustration, it is cylindrical in shape, about $4\frac{3}{8}$ in. in height and $1\frac{3}{4}$ in. in diameter and is composed of a non-conducting material, "Micarta." Cut in the barrel is a slit, running almost the length of the cylinder, which allows the exit of the copper binding wire. The copper wire is wound around a brass spool which fits snugly into the cylinder. The brass spool is $3\frac{5}{8}$ in. in length and $1\frac{3}{8}$ in. in diameter. The end, through which the spool enters, has a disk provided with



Insulated spool reduces hazards in cable binding

a tightening button and a spring. When pressure is applied to this button, it locks the spool in such a manner that it will allow the worker to apply a great stress to the copper wire spirals around the conductors that he is joining, thereby insuring a substantial and satisfactory connection. Another outstanding feature of the new device is that the mechanical construction is such that, in the event the splicer loses control of the spool, the copper wire will not unravel and thus come in contact with other cables that may be energized.

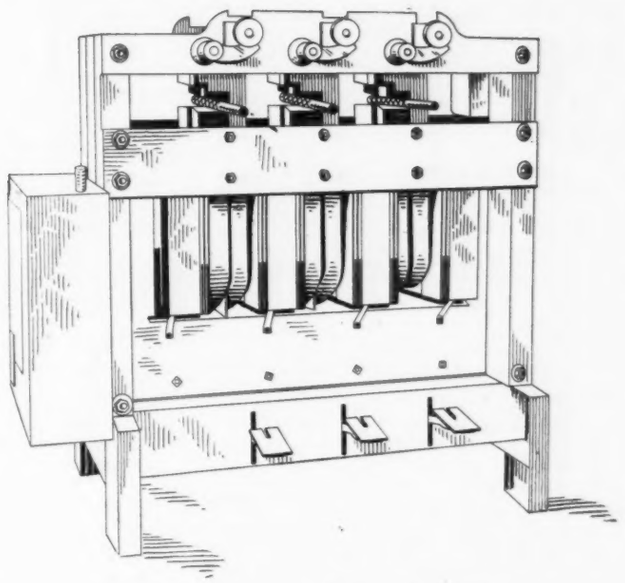
Electric Rod Heater Improves Production Conditions

By H. A. HANDS
New England Power Association, Boston, Mass.

WHAT is believed to be the largest electric rod heater thus far built has recently been placed in service in a New England metal-working plant with such excellent results from the production standpoint that the manufacturer has ordered a duplicate unit. The unit is a modification of the standard Berwick rod heater made by the American Car & Foundry Company, New York, and accommodates rods of 2¼ in. maximum diameter and 18 in. maximum heating length. To handle such large stock the electrodes have been spread wider apart than usual, the upper and lower halves of the jaws have been given increased separation, and air-operated cylinders have been provided to obtain the desired clamping pressure.

The usual treadles have been replaced by foot-operated air valves. Six transformer taps have been provided to enable the voltage to be varied to modify the heating time at will. Maximum demand of the unit on single-phase supply was 96 kw. (instantaneous) on 1½-in. rod and 102 kw. on 1¾-in. rod, the respective energy consumptions being 2.45 and 3.7 kw.-hr. per piece. The maximum 15-minute demands were 71.8 kw. with the 1½-in. rods and 77.3 kw. with the 1¾-in. rods. The pieces are brought up to red heat for subsequent working, and since the introduction of electric heating only one heating has been required, against two previously for two forming operations.

A test was recently run on 1½-in. diameter rod and later on 1¾-in. rod. The electrodes were spaced 17⅝ in. apart and the transformer taps so connected as to give a nominal secondary voltage of 4.8 on 550 volts primary. However, the line voltage was somewhat above normal, 560 to 570 volts, so that the rod was probably subjected to almost 5 volts. Graphic meters installed pictured the variations in voltage current and wattage, sample sections of the charts taken during the test on 1½-in. diameter stock being shown herewith. Because of the use of a current transformer of too high a ratio the integrating watt-hour meter gave too low an indication to be accurately read and, therefore, power consumption was determined by integration of the graphic wattmeter chart.



Electric rod heater takes stock to 2¼ in. maximum diameter

Table I—Electric Heating of Steel Rods

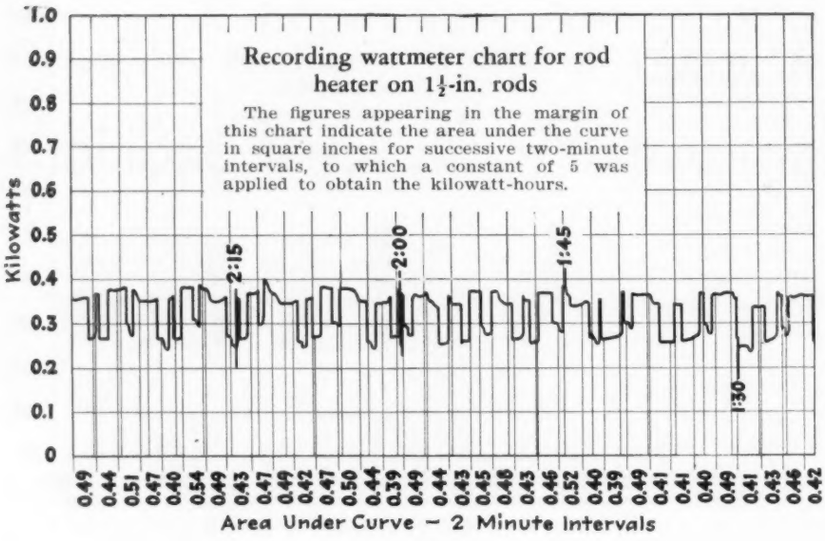
Item	1½-In. Diameter Rod	1¾-In. Diameter Rod
Number of pieces heated	47	12
Time required, minutes	99	38
Energy consumed, kilowatt-hours	115.1	44.4
Average production over entire run, minutes per rod	2.1	3.17
Average power consumption over entire run, kw.-hr. per rod	2.45	3.7
Actual time to heat one rod, average, minutes	5.47	8.36
Maximum instantaneous demand, kilowatts	160	178
Maximum fifteen-minute demand, kilowatts	71.8	77.3
Average load during run, kilowatts	70	70
Capacity of heater per nine-hour day, pieces	250	150
Average voltage during test	570	560

Table I gives the data and results obtained from the tests. Conditions differ somewhat for the two runs; the 1½-in. rods were used for production, and as only one operator is needed for both the heating and forming operations, there is a slight delay in putting in a cold bar after the hot one has been removed. Since the forming machines were not set up to take the 1¾-in. stock no operations were performed on these after heating, so that a mechanic was available immediately to replace the hot bar by a cold one.

No attempt was made to secure similar data for other secondary voltages. Evidently the time cycle could be varied one way or another to suit the requirement of the process and to tie the heating in with the subsequent operations to obtain the optimum cycle.

Disadvantages incident to the use of this machine are few, and none of them is of major magnitude:

1. First cost of the equipment is somewhat higher than that of equivalent fuel-fired furnaces, increasing the fixed charges slightly.
2. Electrode jaws become pitted slightly and require perhaps ten minutes' dressing during the day.
3. Bar stock fairly free from heavy surface scale should be used to prevent local hot spots at the jaws with resultant pitting of the work.
4. The cost of heating each bar may be somewhat higher than for fuel, depending on the relative unit costs of the heat source.



Recording wattmeter chart for rod heater on 1½-in. rods

The figures appearing in the margin of this chart indicate the area under the curve in square inches for successive two-minute intervals, to which a constant of 5 was applied to obtain the kilowatt-hours.

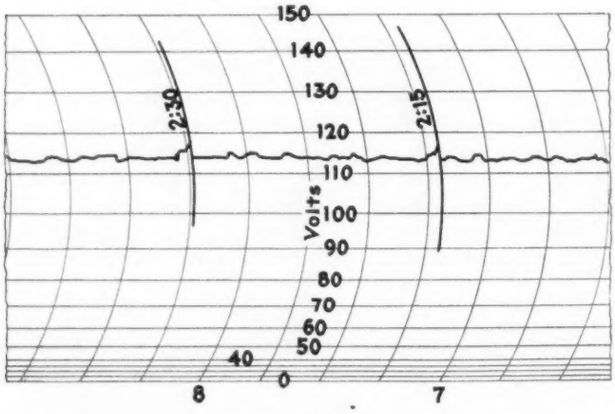
Schedule of Operation During Period Covered by Wattmeter Chart

Piece No.	Time In	Time Out	Piece No.	Time In	Time Out
5	1:19:30	1:25:30	22	1:56:45	2:02:30
6	1:20:45	1:26:30	23	2:00:00	2:05:45
7	1:23:15	1:28:30	24	2:01:15	2:07:15
8	1:26:00	1:32:15	25	2:03:15	2:08:30
9	1:27:30	1:33:15	26	2:06:15	2:12:15
10	1:30:15	1:35:45	27	2:08:00	2:14:00
11	1:33:00	1:39:15	28	2:09:30	2:15:00
12	1:35:00	1:40:15	29	2:13:00	2:18:15
13	1:37:00	1:42:15	30	2:14:45	2:20:00
14	1:40:15	1:45:45	31	2:15:45	2:21:00
15	1:42:15	1:47:45	32	2:19:00	2:24:15
16	1:43:15	1:45:15	33	2:20:45	2:26:30
17	1:46:45	1:52:00	34	2:22:15	2:27:30
18	1:48:45	1:54:00	35	2:25:00	2:30:30
19	1:50:15	1:56:00	36	2:27:15	2:31:45
20	1:53:00	1:59:15	37	2:28:30	2:33:45
21	1:54:45	2:00:15	..	.....	.....

Advantages accruing from the use of this method of heating are numerous and striking:

1. It has previously been necessary to heat the rods twice to perform two successive forming operations, but now only one heating is required, saving time, effort, fuel, scale, etc.
2. Each piece is at an oxidizing temperature for only two or three minutes, as against 30 to 45 minutes per heating in the fuel-fired furnaces, so that scale and decarburization are both greatly reduced. The improved surface condition also means increased life of dies.
3. Working conditions around the heater are so greatly improved that the original layout of the surrounding equipment, laid out to give plenty of room between the fuel-fired heaters and the machines, is to be changed to conserve space, save steps and speed up production.
4. The ability of the operator to handle the rods at their unheated sections with bare hands instead of with tongs saves time and inconvenience in several ways.
5. "Rejects" are reduced because the metal, hotter on the inside than on the surface, flows more freely during forming operations, giving a better fiber structure and eliminating the frequent occurrences of relatively "cold" forming with its subsequent hazards. The company's consulting metallurgist has actually recommended that elimination of the usual subsequent heat treatment be tried, since microphotographs indicate sufficiently desirable grain structure as the piece is received from the hot-working processes.
6. It is expected that the machining operations which follow will be more easily accomplished.
7. Fully three-quarters of an hour is saved each morning, since the heater is ready for operation immediately upon the arrival of the operator.
8. No auxiliary equipment is required and the operation is as dependable as the power service itself.
9. Maintenance is negligible, since the only parts which will need replacement for years will be the electrode jaws.
10. Should production be interrupted for any reason, the heater can be kept idle for an indefinite length of time without attendance and without power consumption, and yet will be immediately available upon the removal of the temporary hold-up.
11. For limited production, the heater can be operated at reduced capacity with almost directly proportionately decreased power requirements (no-load transformer loss about 3 kw.).
12. Should one electrode be accidentally damaged, the remaining jaws are still available for production.
13. There are no fumes disseminated through the shop and no appreciable heat is radiated from the work or machine.

Education of the operator in the correct use of the machine, the addition of a few mechanical fixtures to the heater and the proper timing of the heater with the subsequent operations will decrease labor and power costs still further, it is believed. Whether or not this is realized to be the case, the many advantages inherent to the use of this type of heater make it vastly superior to previous methods and it is anticipated that it will be economical for many other operations in this and surrounding plants.



Voltmeter chart on rod heater supply circuit (constant 5)

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Physiological Reactions from Poor Lighting

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company, Cleveland, Ohio

There is a wealth of evidence to indicate that the eyes will adapt themselves to widely different conditions which may involve severe ocular strain and fatigue, accompanied by a serious drain on the energy resources of the individual. If the eyes emphatically complained of improper lighting it is probable that the advent of visually desirable lighting would be hastened. The eyes are penalized because they usually complain indirectly and indefinitely.

The train of physiological reactions which may be produced by inadequate or glaring lighting is given here-

with. These reactions are experienced so commonly that it is sufficient, for present purposes, merely to recall them:

Cause—Inadequate or glaring lighting or both.

Effect on Eye Muscles—The eyes are often brought nearer to the work, which results in a greater strain on the extrinsic muscles for convergence and in a continuous contraction of the ciliary muscles for accommodation.

An objectionable contraction of the sphincter muscle of the iris.

Effect on Nervous System—Greater expenditure of nervous energy in accomplishing a given amount of useful work.

Nervous Reflexes—Headaches, vertigo or dizziness, blurring vision, digestive disturbances and others.

It is probable that much of the progress toward higher levels of illumination and better lighting has resulted from a demand for greater industrial efficiency. Employers, workers and the public in general cannot be expected to awaken to the importance of lighting in the conversation of human resources unless lighting specialists aid them. There is now available a background of knowledge relating to lighting, seeing and human welfare, so that the utilization of light solely for increasing work production is no longer justifiable.

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Planning Successive Steps in Network Cut-over

By CARL W. EVANS

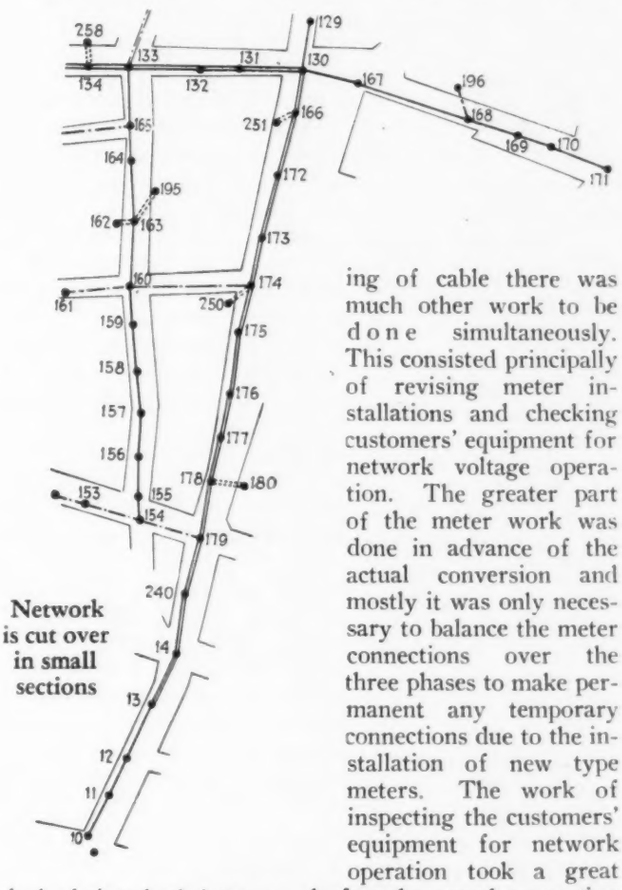
Underground Distribution Engineer
San Antonio Public Service Company, San Antonio, Tex.

The first work begun on the new network system of the San Antonio Public Service Company was that which could be completed without interruption of service. This consisted principally of building duct lines, manholes and new vaults, which was followed with the installation of all new cable that was to form the new feeders and secondary mains. The general plan was to complete all vault installations with connections to the proper primary cable and to resplice the primary cables at a later date to conform with the network system layout. In the case of three new 13-kv. feeders installed expressly for the network this was unnecessary, as they were designed from the first as network feeders, although parts of the cable had been installed previously.

The 13-kv. feeders formed the nucleus from which small sections were gradually enlarged until two or three sections could meet and merge into one. This gradual expanding of the smaller section was greatly simplified by the secondary junction boxes, which were already installed in most manholes. Since these boxes are provided with links it was a simple matter to sectionalize the new system from the old.

In the drawing is shown the extreme eastern side of the San Antonio network area. The method of converting this area was as follows: During the previous period manholes Nos. 132-130-171 had been converted to network operation. The links in the junction boxes of No. 130 would be closed so that the cable section 130-166 would be at network system potential. The services, normally taken from vault 251, would be temporarily connected to the secondary cable 130-166 and the section 166-172 would be de-energized. Work would be concentrated then on vault 251, and when the installation was complete cable sections 166-172 as well as 130-166 would be energized from the network vault 251. It would then be a simple matter to convert one at a time the sections 172-173, 173-174 and 174-175. Work would then be started on vault 250, and then, in its turn, on vault 180. The actual "cut-over" was in this way simplified and few "rushed" splices were made, thus insuring better splices and less danger to workmen. Until the entire system was completed no attempt was made to operate with any feeders de-energized except during light load hours between midnight and morning.

Besides the actual installing of equipment and splicing of cable there was much other work to be done simultaneously. This consisted principally of revising meter installations and checking customers' equipment for network voltage operation. The greater part of the meter work was done in advance of the actual conversion and mostly it was only necessary to balance the meter connections over the three phases to make permanent any temporary connections due to the installation of new type meters. The work of inspecting the customers' equipment for network operation took a great deal of time both before and after the actual converting of the system. In general, these inspections were confined to motors, but not infrequently it was necessary to assist in the reconnection of X-ray auto-transformers, heating elements and voltage relay tripping devices.



Network is cut over in small sections

One of the principal difficulties of an installation of such size and cost is keeping the engineers adequately posted upon the progress in order that they may keep material and equipment on hand in the proper quantities. Without such supervision there is the possibility of a material shortage, causing costly delay, or there may be an overflow in material and equipment, causing a congested storeroom, and, where work is drawn out over periods of a year or more, an unnecessary increase in stock investment. A current construction progress chart erected on field reports submitted semi-monthly proved of great benefit to the electrical engineer during the construction of the system.

Water Heating as an Element

By C. P. RANDOLPH and F. H. McCORMICK

Chief Engineer and Engineer Range and Water Heater Department, Respectively
Edison General Electric Appliance Company, Chicago, Ill.

TO START with, here are some conclusions on the question of domestic electric water heating that is now vexing central-station executives and commercial men. They come from a long series of laboratory tests and observations whose carefully recorded data were applied to the load curve of a typical range-equipped home to show how water heating would affect the load. The offering of these conclusions is not to be taken as a claim of superiority of laboratory tests over competent field investigations; the greater value of the latter is admitted. But there are no results of comprehensive field studies available. Here is what the laboratory says:

1. With modern, well-insulated tanks hot water may be delivered at tank outlet at a monthly efficiency as high as 93 per cent. Hence, no important reduction in energy consumption can be hoped for by increasing tank insulation.

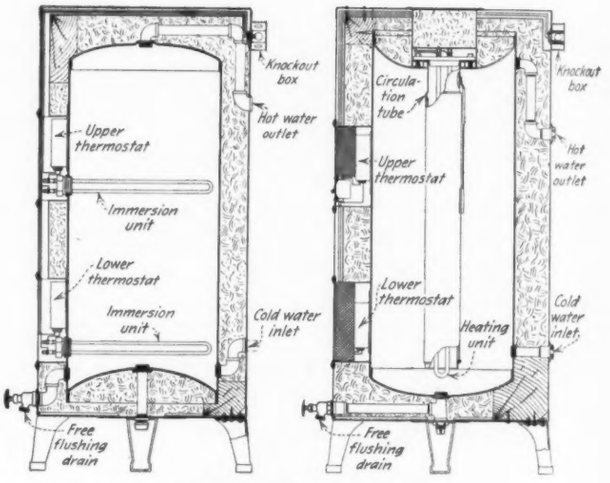
2. Full automatic hot water service, under northern conditions in the average home, can be delivered for 335 to 415 kw.-hr. per month. The higher energy per month, by reason of securing desirable load curve characteristics, may very well result in lower utility costs to serve per month. Therefore, the choice of system should not be based on kilowatt-hours per month only.

3. The energy consumption per month, if the hot water consumption is of the order of 10 gal. per person per day, may be as low for full automatic hot water service as for manual service, which latter requires that the housewife turn on the switch well in advance of the time she wants hot water.

4. A manually operated hot water heater can be installed for only one purpose—to enable the householder to keep down the monthly energy consumption by doing without a satisfactory supply of hot water. The load factor of a manual system is necessarily low (such a system must be of relatively high wattage and its hours of use short); therefore, a relatively higher rate should be charged, and the higher rate of itself forces the user constantly to try to use as little hot water as possible.

5. The monthly losses from the tank, as actually measured under operating conditions, are substantially lower than calculated from idle losses times hours of use, because under operating conditions the lower part of the tank is usually at fairly low temperatures.

6. Pipe heat losses in the home are considerably higher than tank losses.



Types of heaters tested

The construction of the heaters tested are shown by these sections. At the left is the side-immersion type and at the right the accelerator tube design.

7. It is practicable to deliver high-grade hot water service from a carefully designed heater with a temperature variation at the tank outlet not exceeding plus or minus 10 deg. F. during the entire day. This is higher quality service than exists in nearly all homes today.

8. The "flexibility" of electric water heating systems, to meet unusual or emergency hot water withdrawals, varies enormously. If a tank should be completely emptied, 130 deg. F. water will be available in one-half hour with the most flexible type to $9\frac{3}{4}$ hours with the least flexible.

9. It is practicable to deliver full automatic hot water service to the average customer, under northern conditions, with a tank of 30-gal. capacity in combination with a time switch and with little or no addition to the diversified demand imposed on the station by the domestic customer using an electric range.

10. It is possible, with a properly designed water heating system, and using a relatively small tank, and without the use of time switch or other auxiliary control device, to obtain 25 per cent of the energy consumption in the night hours.

11. A two-unit system will impose a smaller addition to the diversified demand of a household already using lights, appliances and range than will a water heater of high or intermediate wattage. This follows from the fact that some hot water withdrawals occur during the cooking hours and the higher the wattage the more the water

# of Residential Load

What happens when automatic electric hot water service is added to the individual domestic load that already includes a range.

Data from laboratory tests are not so inclusive as field studies but, within the limitations of controlled cases, are more accurate.

heater load tends to concentrate into this cooking demand period. On the other hand, the low-wattage, base-load unit, since it cannot quickly recharge the tank after ordinary water withdrawals, must consume fewer kilowatt-hours during this peak cooking period.

12. The connected load of a properly proportioned two-unit system is not an indication of its diversified demand. The booster unit is in operation so few hours per month during the 4 p.m. to 8 p.m. period that its effect on diversified demand can be nearly neglected.

The tests*

The tests that supply the foundation for these conclusions were made on eight representative systems ranging from high-wattage, low-storage capacity and low-wattage, high-storage capacity systems and including night storage. Of the eight tested four may be considered as basic systems and the others as modifications. The systems studied are:

Basic

A. High-wattage, single unit, 5 kw., 18-gal. accelerator tube tank.
B. Low-wattage, single side-immersion unit, 2 kw., 50-gal. tank.
C. Low-wattage, two side-immersion units, 500 watts lower unit, plus 1.5 kw. upper unit, 50-gal. tank.
D. Night-storage, single side-immersion unit, 2.5 kw., 100-gal. tank with time switch.

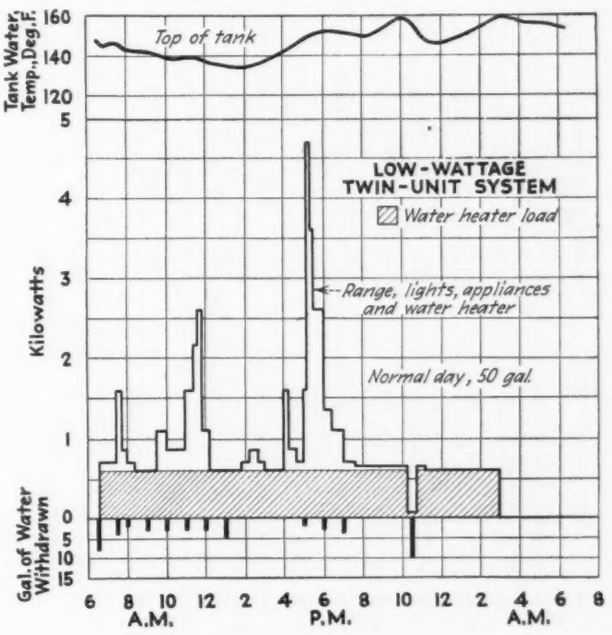
Modifications

E. Accelerator tube type, 0.60 and 1.5 kw., 30-gal. tank.
F. Accelerator tube type, 0.75 and 1.5 kw., 30-gal. tank, with time control.
G. Hartford system, night storage, two 2-kw., side-immersion units, 60-gal. tank, transfer time control.
H. Time control, automatic mixing valve, single 1.10-kw., side-immersion unit, 50-gal. tank.

Only full automatic service is considered in the comparisons. The writers believe that the ultimate success of electric water heating from both customer's and company's viewpoint can be attained at the higher revenue required only by furnishing a liberal and completely automatic hot water service. Table II shows the standardized hot water service and conditions on which all the tests and comparisons are based. It is believed from an examination of all available information on gas and electric water heating that this standard represents good hot water service for the family of four or five in a home with one bathroom and laundry done at home. An average of 8 to 10 gal. of 145 deg. F. water per person per day is generally accepted as representing northern conditions in the better grade home. The standard chosen for an average family of 4.3 persons is an average of 9.8 gal. per person per day.

Daily hot water usage, however, varies greatly from the average, even within the same family. For the results to be of practical value, maximum and minimum variations in the daily hot water usage must be considered. To simplify the tests, three standard days were set up, a minimum of 20 gal., a normal day of 50 gal. and a maximum day of 75 gal. While the maximum day occurs infrequently (about once a week, as laundry day, etc.), yet it controls the size and wattage of the water heater. For this reason only load curves from the test results for maximum days are shown in this article, although draw-off measurements were, of course, made for minimum and normal days also, and combined —as in Table II—to secure monthly energy consumption. The minimum day controls the extent to which we are justified in designing for high efficiency (or low heat losses).

A standard cold water temperature of 45 deg. F. was selected as representing winter conditions, which impose the heaviest requirements on the heater. A standard hot water temperature of 145 deg. F. at the tank outlet was decided upon as presenting the minimum temperature for first-class service. Dish- and clothes-washing requirements practically control this temperature. A room



Booster not needed on normal day

This is the normal day performance of the same system shown in graph E for a 75-gal. day. It shows normal load carried on the base unit, as is also the case in the system of graph F.

Standard water heaters, manufactured by the Edison General Electric Appliance Company, Inc., were used on all tests. Sizes and wattages were chosen to deliver the specified hot water service. Acknowledgment is made to Messrs. L. F. Berg and W. L. Goetchius for performance of tests.

Effect of Water Heating

These graphs show the effect of water heaters of the four basic systems on a typical residential load, including electric range, as shown in N.E.L.A. range committee report for 1925-26

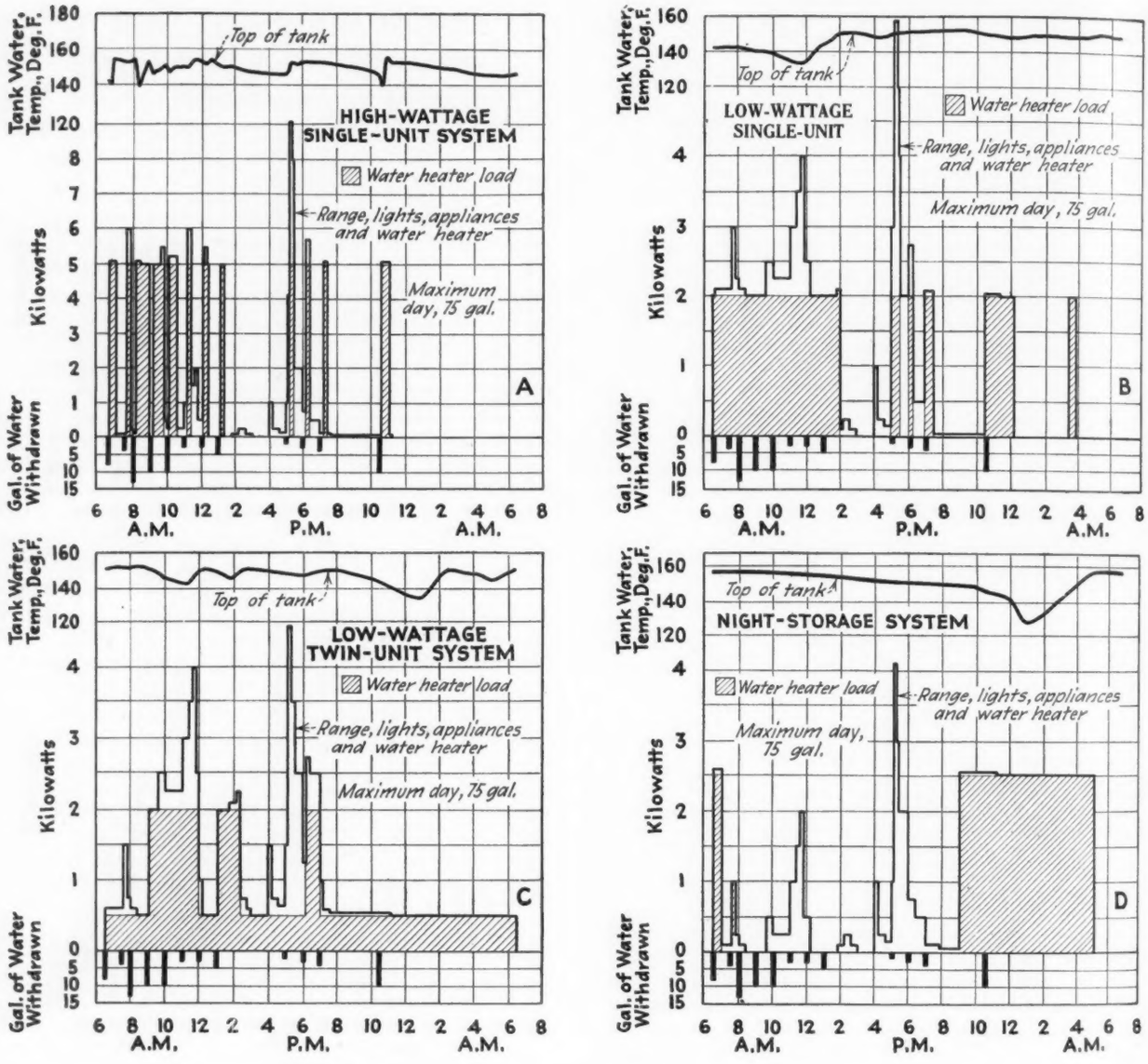


Table I—Water Heater Performance Referred to Graphic Data

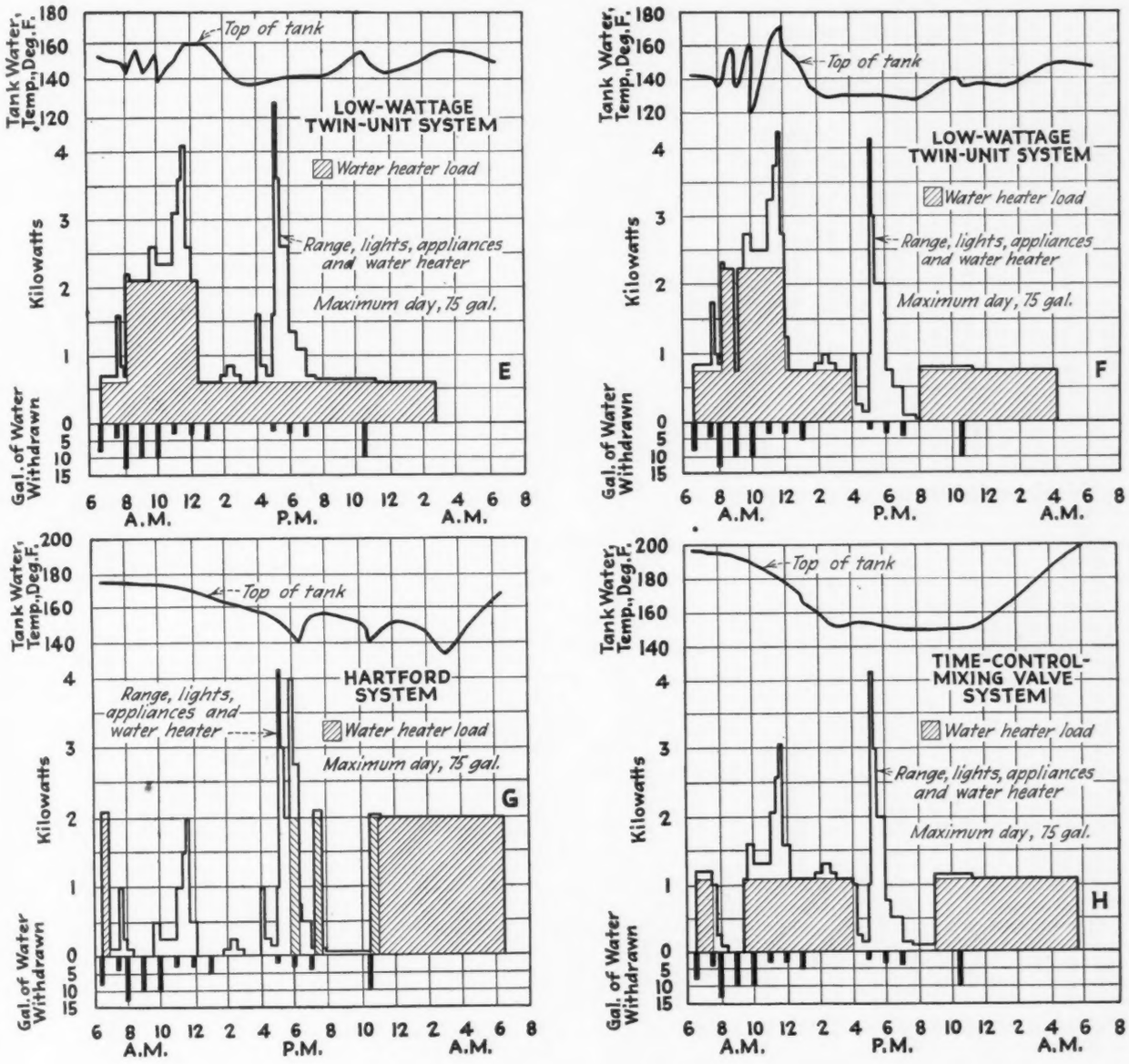
(See comments on Table I on next page)

	Graph A	B	C	D	E	F	G	H
Water Heater Characteristics*								
1. Energy per month, kw.-hr.	332	365	356	368	336	338	389	414
2. Gallons per kw.-hr.	3.88	3.52	3.61	3.5	3.83	3.81	3.3	3.1
3. Efficiency								
Tank outlet (no pipe losses)	94.3	85.5	87.8	85	93	92.5	80.3	75.5
Faucet (including pipe losses)	84.6	76.8	77.4	77.1	82.7	82.4	71.2	66.5
4. Tank losses, 145 deg. F., idle (watts)	52	78	84	104	65	65	135†	152.0‡
5. Hours to accumulate some 130 deg. F. water at tank outlet, starting cold	0.45	5.4	3.5	9.75	0.86	0.8	1.75	9.75
6. Percentage of energy from 9 p.m. to 7 a.m.	17.2	24	28.6	100	25.75	35.4	98.2	46
Characteristics of Total Residence Load of One Customer								
7. Kilowatt-hours per month	492	525	516	528	496	498	549	574
8. Kilowatt maximum demand	9.12	6.12	4.62	4.12	4.72	4.25	4.12	4.12
9. Monthly load factor (percentage)	7.37	11.75	15.3	17.5	14.37	16	18.2	19.0
Quality of Hot Water Service								
10. Percentage of water withdrawn from tank outlet on maximum day within ±10 deg. F. of average	100	94.7	100	100	98.7	83	100	100

*Results are corrected to standard conditions: Water at tank outlet 145 deg. F., cold water 45 deg. F. and room temperature 75 deg. F.
†Loss at 170 deg. F., the tank temperature used in tests, with mixing valve to deliver 145 deg. F. water.
‡Loss at normal tank temperature, 200 deg. F., with mixing valve to deliver water at 145 deg. F.

on Residential Load

Modifications of the four basic systems of water heating result in more desirable load characteristics. These graphs are erected on the same residential load curve as those on the facing page



Comments on Table I

Note that the kilowatt-hours per month (line 1) for the eight systems vary from 332 to 414—all delivering the same number of gallons of hot water per month at the same temperature. The efficiency at the faucet (line 3) will usually—in an actual home—be lower than the figures here shown, if the hot water pipe is not insulated, is longer than 22 ft., or larger than ¾ in. Tank losses, 145 deg. F. idle (watts), (line 4) are not a measure of the monthly kilowatt-hour losses from the tank, as this latter figure depends also on the average temperature of the water actually maintained in the tank throughout the month.

A high-wattage, small tank system (graph A) obviously is maintained full of 145 deg. water nearly all the time, whereas, taking the other extreme, the night storage system (graph D) large tank is nearly filled with cold water throughout each day. In line 5, "Hours to accumulate some 130 deg. F. water at tank outlet, starting cold," is an indication of the flexibility of a system to meet unusual hot water demands. In any family there may be days—perhaps occurring only several times in a year—when a tank will be completely emptied of hot water.

With the night storage system (graph D) the family will have to wait till next day for more hot water—a serious inconvenience, whereas with several other systems at least some fairly hot water will be available in a short time. The statistics of line 10, with the temperature curves of the charts, merely show that each system has been safely designed to give good hot water service.

temperature of 75 deg. F. is about right for a kitchen installation (though somewhat high for a basement). Twenty-two feet of ¾-in. pipe, covered with 1 in. of magnesia pipe insulation, was installed between the heater and faucet as being representative of the average length to a bathroom or kitchen sink.

Basis for comparisons

To decide between different proposed water heating systems, the following characteristics must be known for each system:

1. Quality of hot water service rendered. (The temperature must not vary too greatly from 145 deg. F.)
2. Kilowatt-hours per month to deliver the standard hot water service.
3. Diversified demand imposed on station and transformer by household load.†
4. Merchandising features, such as retail price of installed water heater, size and weight of tank, appearance, convenience, etc.

†*A forthcoming report by the N.E.L.A. water heating committee will deal with the diversity factor of water heater load.*

The laboratory tests show that each system is capable of delivering the hot water service set up as standard and accurately determine the *relative* energy consumptions of the different systems. The tests also serve to indicate roughly, from the 24-hour load curves, the probable relative demands. In considering the load characteristics of each of the systems, we are concerned not with the water heating load alone, but with the total load for the individual home. In other words, any consideration of the water heater as a separate and distinct load is misleading, for the water heater practically always supplements a previously existing load in the home; therefore, we must consider the total load of the individual home after the water heater is installed. A typical shape of load curve for an average home with lights, appliances and range was selected from the data published by the N.E.L.A. range committee in 1926 and used as the foundation of the graphic studies. It is clear that the type of water heater which will result in the highest load factor for the load of the domestic class of customers will be that which by automatic means or otherwise will fill the valleys with little or no increase in maximum demand.

The Pros and Cons

High-Wattage System—Graph A.—For quick recuperation, minimum floor space occupied, high efficiency and flexibility of performance, this system is notable. Against it are high demand, probable higher cost of wiring and small use of off-peak energy.

Low-Wattage, Single-Unit System—Graph B.—The large tank capacity, as compared with the high-wattage system, provides sufficient storage to enable the lower-wattage 2-kw. heater to carry through the required schedule. This combination has a lower demand than the high-wattage heater, but there is still a tendency for a fairly high demand to come on the range peak. Slightly larger amount of night load is obtained than with the high-wattage system, while the efficiency is lower due to the use of a larger tank.

Low-Wattage, Two-Unit System—Graph C.—This system is a substantial improvement over the low-wattage single unit in that the lower unit is designed to carry the base load and operates with a very high load factor, while the upper unit comes into use only occasionally as a booster unit to take care of heavy demands. The diversity of the upper unit is so high as to have little probable effect on the station demand. This system uses a fairly high proportion (28.6 per cent) of energy during the night hours. Due to the losses from a comparatively large tank, the kilowatt-hours per month (356.0) are somewhat higher than for the high-wattage system. With the 1,500-watt unit fairly close to the top, hot water is secured considerably sooner when starting cold as compared with the single-unit system—3.5 hours as against 5.4 hours. The advantage of this type arises from the fact that the daily hot water uses of a family vary enormously, approximately in the ratio of four (or more) to one; that is, the maximum day hot water usage is about four times that of the minimum day. The lower or "base-load" unit, being of low wattage, places a large part of the total energy in the night, as it requires long hours to restore with 500 watts the lower two-thirds of the 50-gal. tank to 145 deg. F. after each day's use. This unit furnishes nearly all the required energy for the minimum and normal days, which together are 25 days per month. The upper or "booster" unit is therefore idle most of the time, but is always ready to supply energy for the maximum days. Obviously, the diversified demand of the upper unit for a number of customers will be low because it is furnishing energy for very few total hours per month and then usually during morning hours. The tank size is not impractical, the efficiency and the rate of recuperation if emptied are good and the demand is low.

Night-Storage System—Graph D.—This heater is of the simplest construction, but is necessarily of very large capacity (100 gal.) to provide the necessary hot water storage at 145 deg. F. As it is charged only during the night hours (9 p.m. to 7 a.m.) and because there is some mixing of hot and cold water, a smaller tank will not deliver the 75-gal. maximum day service. This heater does not, of course, add anything to the day load. A 2,500-watt unit is required to recharge this large tank in ten hours after a maximum day. Due to its great size and weight, it cannot usually be installed in the kitchen. If emptied of hot water, no more can be obtained until the next day.

Low-Wattage, Two-Unit System, with Accelerator Tube—Graph E.—The tank size is relatively small, 30 gal., because of the use of the accelerator tube. There is little likelihood of the booster unit coming on at the time of the range peak as the accelerator tube permits the lower unit to accumulate hot water below the upper thermostat during the afternoon period. It should be noticed that the amount of night energy is quite substantial (25 per cent). The "booster" unit is called into play only during the morning of the maximum day, five days per month. (See chart "Booster not needed on normal day.") The kilowatt-hours per month (336.0) is very low due to the use of a small, efficient tank, with accelerator tube and low-wattage unit.

Low-Wattage, Two-Unit System, with Acceleration Tube and Time Control—Graph F.—This heater is identical with that of the preceding system, except that the wattage of the lower unit has been increased to 750 to compensate for the four-hour off period. By using a time switch to cut out the lower unit in the water heater during the cooking and lighting load peak, the water heater can be added to the existing load without increasing either the peak demand of the residence class on the station or the distribution investment requirements. The booster unit will be on so seldom its effect on demand between 4 p.m. and 8 p.m. can nearly be neglected. It is only on the maximum days. This system combines small tank size, high efficiency, quick recuperation, ease of servicing, and low station demand.

Night Storage, Transfer Time Control System—Graph G.—This system, originated and used by the Hartford Electric Light Company (but without the mixing valve as standard practice), approximates the night storage system. By using two units and operating the tank heater at a fairly high temperature (170 deg. F.), the tank size is reduced to 60 gal., which is quite practical. As the upper or booster unit is on but seldom, it will have only slight effect on the maximum demand of the household load. During the night hours 98 per cent of the monthly energy consumption occurs. The time switch transfers the load from the lower unit and thermostat, on at night, to the upper or booster unit and thermostat during the day hours. Hence, the total connected load cannot exceed 2 kw.

Time-Control System, Single Unit, with Mixing Valve—Graph H.—This heater is operated at a high water temperature—200 deg. F.—to secure the necessary storage with a moderate size of tank and utilizes an automatic valve to mix cold and hot water at the tank outlet, thus delivering 145 deg. F. water to the faucet. While the energy consumption per month of this system is high, it may, by reason of securing desirable load characteristics, result in lower utility "cost to serve."

Table II—Standard Water Heating Conditions for Northern Section of United States

75 deg. F. room temperature. 45 deg. F. tap water temperature. 145 deg. F hot water temperature at tank outlet.

	Gal. per Day	Days per Month	Gal. per Month
Minimum day	20	12	240
Normal day	50	13.4	670
Maximum day	75	5	375
	42.2 ave.	30.4	1,285

	Draw-Off Cycle		
	Minimum Day	Normal Day	Maximum Day
6:30 a.m.	..	8	8
7:30	3	4	4
8:00	2	2	13
9:00	2	3	10
10:00	..	3	10
11:00	2	3	3
12:00	3	3	3
1:00 p.m.	1	5	5
5:00	..	2	2
6:00	1	3	3
7:00	2	4	4
9:00	4	..	..
10:30	..	10	10
Total	20	50	75

¾-in. hot water pipe 22 ft. long with 1-in. insulation.

It is important to note that the hot water draw-off schedule shows four distinct heavy draw-off periods, on each standard day—heaviest in the early morning (baths, house cleaning, or laundry); light, at noon (mealtime); light, at early evening (mealtime), and occasionally heavy in late evening (baths), with minimum withdrawals through two periods—the afternoon and through the early evening. On the morning of the maximum day 41 gal. is withdrawn in only 3½ hours; a severe test on any water heater, but essential to insure hot water service on laundry day. In an actual home there will be more frequent withdrawals in smaller quantities, but they cluster generally into the four periods above described. The smaller number of withdrawals with more water per withdrawal was chosen to simplify the testing.

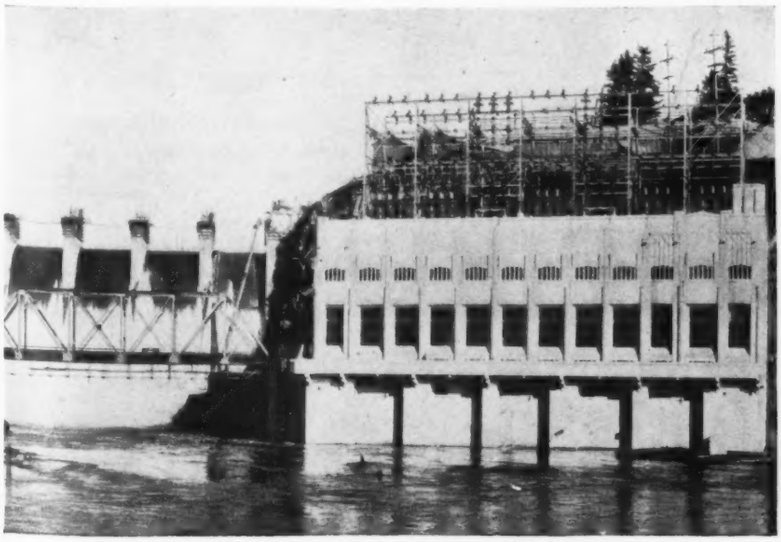
Upon the basis of our experience, as reflected in the test data included in this article, we conclude that the correct type of electric water heating system is that which is the best combination of the following properties—tank of minimum size, high efficiency, flexibility to meet varying hot water withdrawals, minimum diversified demand of load on station and transformer and best merchandising appeal.

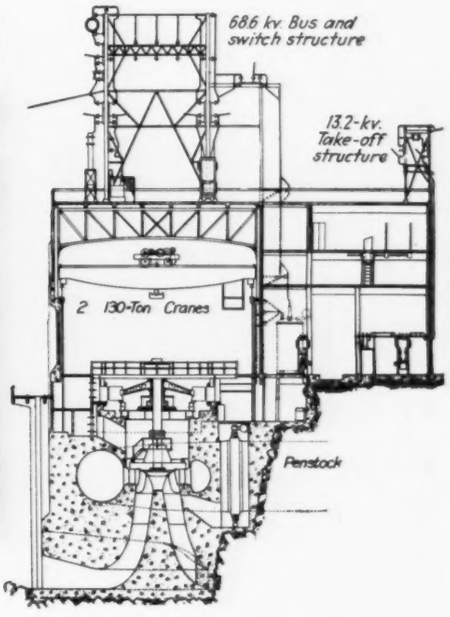
The writers cannot presume to say which is the best system. The decision lies with the utility executive, familiar with his local conditions. But certain conclusions seem obvious—the 5-kw. water heater with its high demands and the 100-gal. tank heater, because of its great size and cost, need not be adopted. The remaining six systems combine, to a varying degree, the low utility cost of energy of the night storage system with the attractive sales features of the high-wattage system. May we venture the reminder that, no matter how low the cost to the utility for energy to supply the electric water heating system finally decided upon, selling the water heater to the ultimate consumer is the big job. If, in our efforts to secure low cost per kilowatt-hour, we sacrifice the quality of hot water service to the consumer or furnish the merchandise manager an appliance impractical of sale to the consumer, we will add a valuable load on paper, but not in practice.

▼

Roof-Mounted Switchrack Saves Space

Physical location of the 68.6-kv. switch and bus structure was the subject of careful study in design of the Ruskin plant of the British Columbia Railway Company, Ltd. Due consideration of both cost and convenience of access for operation and maintenance conclusively pointed to the station roof. The structure is composed, with the exception of crosstie girders near the top, of solid structural steel members, the girders mentioned being the only latticed members in the entire structure. Conductors are supported on bus type insulators or in strain, depending upon their location. Electrically and mechanically, the completed structure is a good example of simplicity in arrangement and economy of design combined with commendable features relative to convenience and safety.





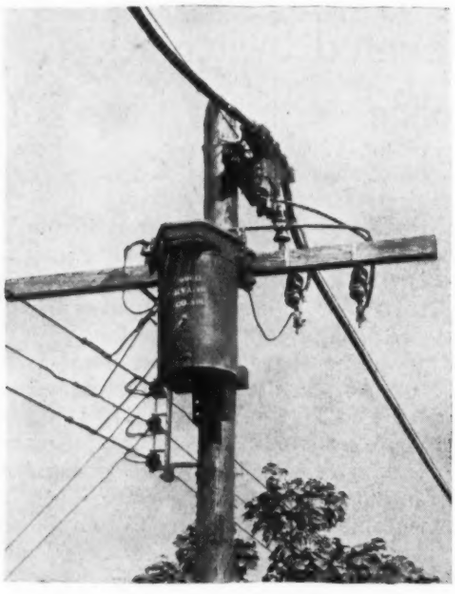
Simplicity, economy, convenience and safety are combined in this roof-mounted bus and switch structure

Aerial Cable Solves Rural Line Problem

JUST east of Elyria, Ohio, on the system of the Ohio Public Service Company is a 3-mile stretch of wooded highway that has defied the distribution department of the company for years. Heavy winds consistently put this 6,900-volt, three-phase, rural service line out of service. It was not practical to overbuild the trees and the service was much too rough for ordinary tree wire construction. It was decided finally to install an aerial cable which consists of three No. 2 rubber-covered conductors covered with a waterproof braid. It is carried on a ½-in. galvanized steel messenger with a tensile strength of 10,000 lb., calculated for a safety factor of two with half-inch ice on the cable in a 60-mile wind at 0 deg. F. The messenger is grounded at 500-ft. intervals. The suspension distance of the cable on the messenger is 16 in.

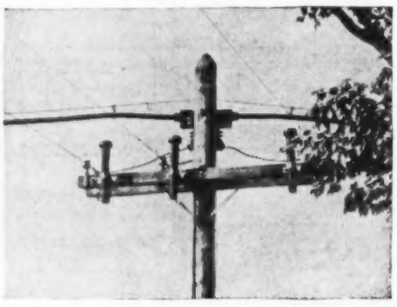
Three miles of this

The trees could not be trimmed without destroying their beauty, overbuilding was impractical and tree wire did not last long. Aerial cable was the answer.



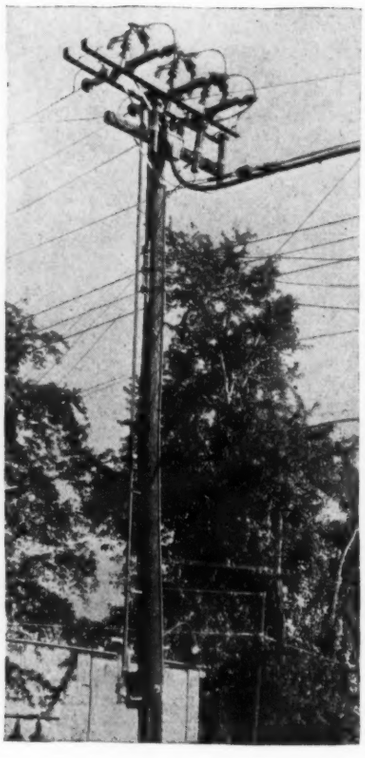
Transformer installation

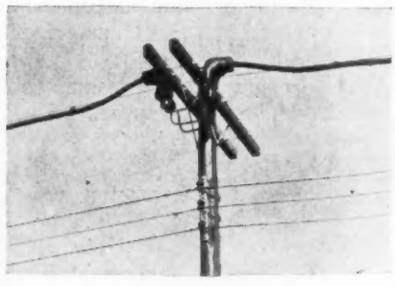
Transformer taps were made in potheads and brought out with tree wire, which also is used for the secondary.



Lightning arresters where needed

Only where primary take-offs were made from the cable were lightning arresters used to protect against surges from long open-wire construction.





Sectionalizing

An economical method for sectionalizing at intermediate points was provided by backing two side entrance potheads on a double arm and jumpering between pothead terminals.

Switch sectionalizing

At the ends of the cable runs pole-top switches were used to break into the open construction.

Series Motor Sizes for Rapid Acceleration

By R. M. KENAH

General Engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IN THE case of the selection of series-wound motors, or compound motors with heavy series fields for accelerating service, the method of calculation is the same in principle as for shunt motors, but is complicated by the fact that the motor speed is not constant but changes with a change in load.

As an example, let us consider applying a mill type series-wound motor to a blooming-mill roll table. This table, shown diagrammatically in Fig. 1, consists of a number of rollers connected to a side shaft through 1 to 1 ratio bevel gears. The following data are given:

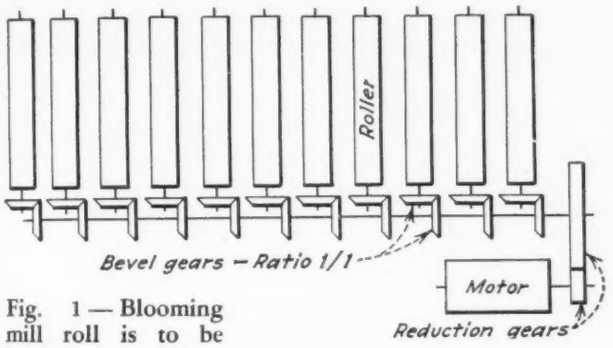


Fig. 1 — Blooming mill roll is to be brought to three-fourths speed in 1.5 seconds

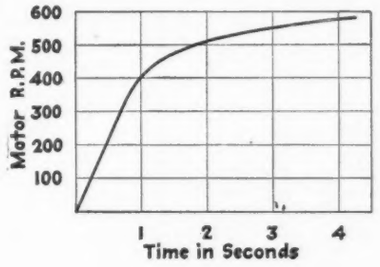


Fig. 2—Nine-tenths speed attained in 2½ seconds

Diameter of rollers.....15 inches = 1.25 feet
Free running table speed.....500 feet per minute
Friction load of table at 500 feet per minute.....50 hp.
WR^2 of table referred to the side shaft, 35,000 pound-feet square

It is required that the table accelerate to 75 per cent of its free running speed in 1½ seconds. The following procedure may be used in determining the proper motor to use:

1. Select tentatively a 150-hp. hour rated, 230-volt, series-wound mill type motor.

Mill type motors are designed especially for rapid starting, stopping and reversing and have armatures of small diameter so as to keep the inertia to a minimum. The WR^2 of the 150-hp. motor is found from the rating sheet to be 510 pound-feet square.

2. From the characteristic curves of the motor selected (Fig. 2) read the motor speed corresponding to the friction hp. load of the table.

50 hp. on this curve corresponds to 620 r.p.m.

The free running table speed of 500 feet per minute corresponds to a roll speed of $\frac{500}{1.25 \text{ ft.}} = 127$ r.p.m.

3. Calculate the gear ratio required between the motor and side shaft.

$$\text{Gear Ratio} = \frac{\text{R.p.m. of motor at friction load}}{\text{R.p.m. of table rollers at friction load}}$$

$$= 620/127 = 4.9/1.$$

4. Calculate the total WR^2 of the moving parts all referred to the motor speed.

To do this the WR^2 of the table is divided by the square of the gear ratio and the WR^2 of the motor armature added.

$$\frac{35{,}000}{(4.9)^2} + 510 = 1{,}460 + 510 = 1{,}970 \text{ pound-feet square.}$$

5. Determine the average motor torque during the acceleration period.

With mill type series or compound-wound motors a class A.E.S. No. 76 or No. 56 resistor may be used giving maximum current peaks of 200 per cent of full-load current. If the accelerating relays are set so as to close the next accelerating contactor when the current drops to its full-load value the average current during the acceleration period may be assumed equal to 140 per cent of full-load current. From the curve (Fig. 3) we find that the current corresponding to the full-load rating of the motor (150 hp.) is 540 amp. The average current during acceleration will be 140 per cent of 540 amp. or 755 amp. By reference to the curve it is found that this corresponds to a torque of 3,300 pound-feet.

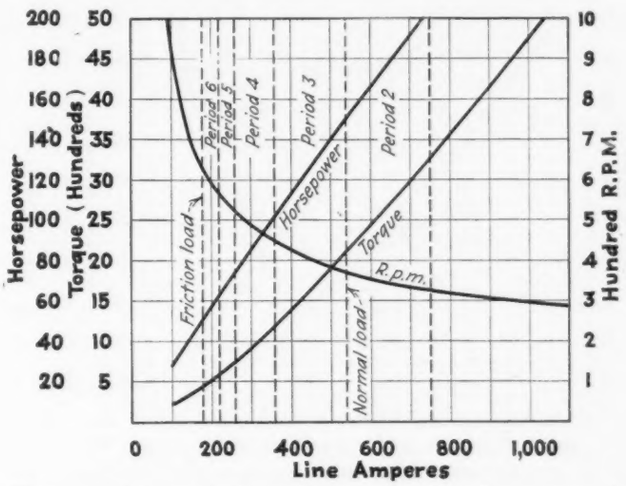


Fig. 3—Characteristic performance of series motor is applied in six steps in acceleration analysis

6. Determine the friction torque of the table at the motor shaft.

The friction load at free running table speed was found to be 50 hp. By reference to the curve (Fig. 3) it is found that the corresponding motor torque is 450 pound-feet.

7. Calculate the net motor torque available for acceleration. This is the motor torque at 140 per cent of full-load current minus the friction torque.

$$3{,}300 - 450 = 2{,}850 \text{ pound-feet.}$$

8. Calculate the rate of acceleration of the motor.

$$\text{Acceleration in r.p.m./sec.} = \frac{308 \times \text{Torque}}{WR^2}$$

$$= \frac{308 \times 2{,}850}{1{,}970} = 445$$

9. This rate of acceleration just calculated can be assumed only up to the point where the last accelerating contactor closes. After the motor is connected across the line, its inherent series characteristics cause a gradual decrease in field strength as the current drops to friction load. This, in turn, causes a decreasing torque and decreasing rate of acceleration. We can assume, therefore, that the acceleration rate of 445 r.p.m./sec. applies only up to a point on the motor curve corresponding to 140 per cent of full-load current of 755 amp. From Fig. 3 this is found to be 325 r.p.m. The time for the motor to reach this speed is found by dividing the speed by the acceleration rate in r.p.m./sec.

$$\frac{325}{445} = 0.73 \text{ second}$$

Table 1—150-Hp. Motor Brings Mill to Running Speed in Eight Seconds

Period	Motor Torque Max.	Motor Torque Min.	Motor Torque Aver.	Net Motor Torque	Rate of Acceleration R.P.M./Sec.	Motor R.P.M. Max.	Motor R.P.M. Min.	Change in Speed	Time of Interval	Total Elapsed Time
1	3300	3300	3300	2850	445	325	0	325	0.73	0.73
2	3300	2100	2700	2250	352	370	325	45	0.13	0.86
3	2100	1200	1650	1200	188	450	370	80	0.42	1.28
4	1200	750	975	525	82	520	450	70	0.85	2.13
5	750	600	675	225	35	560	520	40	1.15	3.28
6	600	450	525	75	12	620	560	60	5.00	8.28

10. We have now to calculate the time for the motor to come up from the point where the last accelerating contactor closes to its friction load speed. This may be closely approximated by dividing the period into four or five intervals as shown on Fig. 3. The maximum and minimum motor torques during the interval can then be read from the curve and their average taken. This torque, minus the friction torque referred to the motor speed, will give the net torque during the interval. The acceleration rate during the interval is then calculated.

$$\text{R.p.m./sec.} = \frac{308 \times \text{net torque during interval}}{WR^2}$$

The time required for the interval is then calculated.

$$\text{Time in seconds} = \frac{\text{Change in speed during interval}}{\text{Rate of accleration during interval}}$$

These calculations may be tabulated as shown in the accompanying table and from these data a speed-time curve for the motor plotted (see Fig. 2). This shows that in 1½ seconds the motor will accelerate to 470 r.p.m., which is 76 per cent of the free running speed of 620 r.p.m.

In the above discussion we have assumed that the roll table must reach a free running speed of 500 ft. per minute. It often happens in problems of this kind that instead of reaching a definite speed it is required that the material on the table be moved a certain distance in a minimum time. It is here that the importance of using the proper gear ratio arises. Too low a gear ratio will give a high free running speed but slow acceleration, and if starts are frequent the motors may overheat. Too high a gear ratio will give rapid acceleration, but the free running speed will be lower. If instead of plotting the motor r.p.m. against time, as shown in Fig. 2, we could just as easily have plotted table speed in feet per minute against time.

Values may be calculated and a curve plotted for several gear ratios. The proper ratio will then be the one which gives the required table movement in the minimum time.

▼ ▼ ▼

Changes Again Made in Hartford's Mercury Unit

During the year's operation, previous to the recent shutdown, the mercury unit at the South Meadow station of the Hartford Electric Light Company turned out 135,000,000 kw.-hr., including that produced by the steam from the mercury condenser, at a net coal rate of 0.72 lb. per kilowatt-hour with 14,000 B.t.u. coal. This corresponds to an average net kilowatt-hour on 10,100 B.t.u. Operation was virtually continuous during the year and was marked by economies fully meeting expectations, but due to failure of a mechanical detail the unit has been shut down for retubing.

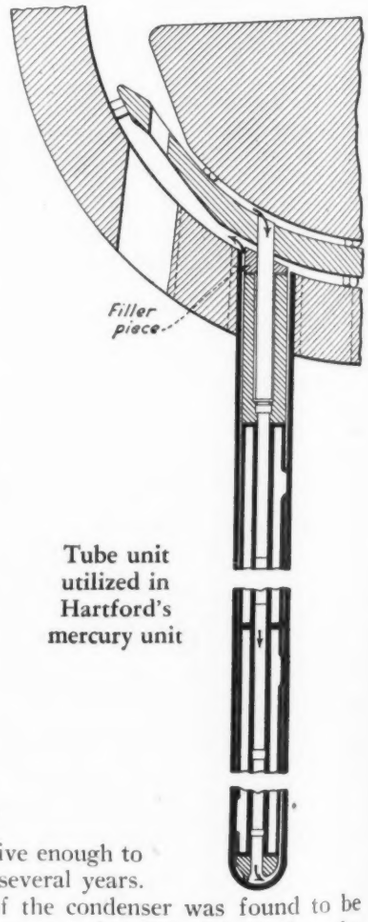
The immediate cause of taking the unit out of service was the development of a slight leak in one of the tubes, accompanied by some bulging in others. Detection of the leak was almost instantaneous by the selenium-sulphide coated ribbon which, in combination with a photo-electro cell, sounds an alarm if any mercury vapor is present in the flue gases. So sensitive is this detector that it will indicate when 2 cu.cm. of mercury is thrown into the furnace with the boiler under full load.

Investigation shows that mercury had nothing whatever to do with causing the leak, but that it was brought about solely through failure of a small mechanical detail. As indicated in the accompanying figure, there is a loose-fitting cast-iron filler piece which surrounds the upper end of each inner tube. Vibration apparently set up repeated movement to the filler piece. This caused minute particles of cast iron to deposit in the small annular space between the outer and inner tubes. Circulation was impeded and overheating resulted. In a few instances the movement of the cast-iron filler piece had caused the bottom inner edge to wear away and finally puncture the top of the inner tube.

There was also some indication of movement of the inner tube itself, in that the lugs which serve to keep the inner tube central with the outer tube were worn.

In retubing, the arrangement is being modified so as to eliminate the filler piece and do away with all loose fits. Tests on these tubes indicate that they will have a higher vapor-producing capacity than the tubes which are being replaced.

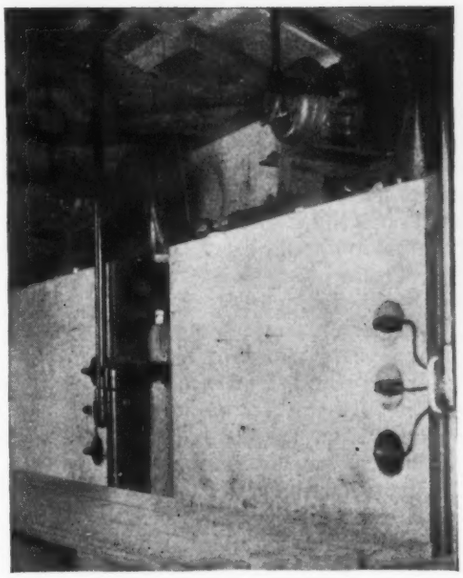
Advantage is being taken of the opportunity, while the unit is down, to disassemble the turbine and subject it to a thorough inspection. All surfaces of the turbine were found to be absolutely clean and there was no erosion or pitting on the blades. The stationary nozzles of the fourth stage showed slight erosion on the exit edges. It is estimated that the erosion was not extensive enough to cause any trouble for several years.



Tube unit utilized in Hartford's mercury unit

The mercury side of the condenser was found to be clean, but a negligible amount of scale had formed on the steam surfaces.

Safety Determines Features of Powder Plant



Electric heat by absent treatment

The four 60-kw. air heaters, as illustrated at the right for drying pellet powder, are located in the right-hand building. The heated air passes underground through a tunnel below the earthwork explosion barrier to the drying ovens, located in the building whose end is shown at the left of the picture.

By E. W. MacCORKLE, Jr.
Power Engineer
Kentucky & West Virginia Power Company, Inc., Ashland, Ky.

THE extreme explosion hazard incident to the manufacture of black granulated blasting and pellet type powder, along with the convenience of electricity for power and heat, led the King Powder Company of Cincinnati, Ohio, to make at its Wurtland, Ky., plant an unusual installation whose electrical features were worked out by R. E. King of the powder company, and C. Coburn of the General Electric Company. To localize possible explosions, the plant is composed of small, isolated buildings, scattered over a large woodland tract. Each process is housed in a separate building or group, some of which must be supplied with light, power and heat. Several groups require as much as 240 kw. for heat or 100 hp. for power ½ mile or more from the source, so a complete three-phase, 2,300-volt, 60-cycle distribution system is in use.

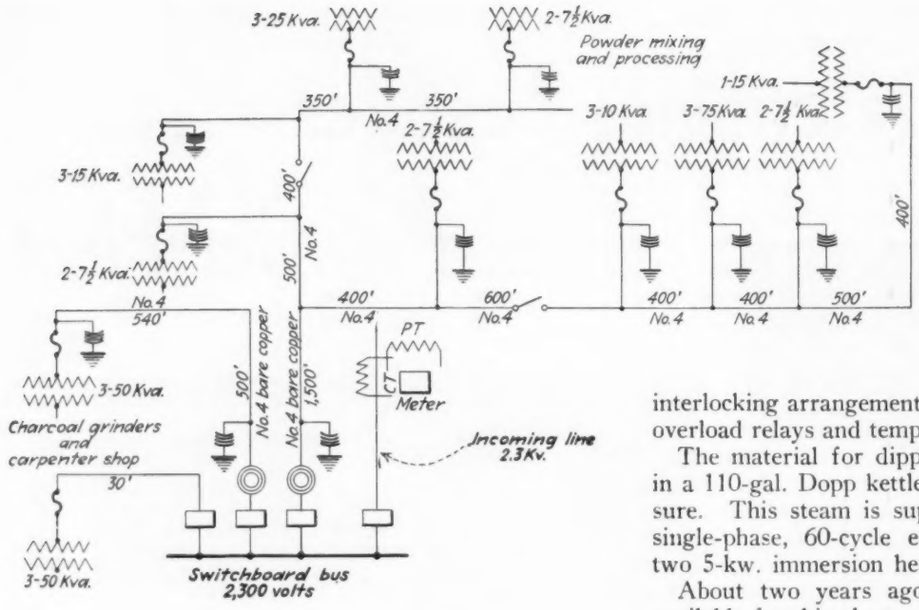
At the time the plant was built central-station power was unavailable, so a 400-kva., 0.8-power factor, 2,300-volt, 60-cycle, three-phase steam-engine-driven alternator was installed, along with necessary boilers, switchboard and accessories. From the power house two 2,300-volt, three-phase circuits of No. 0000 bare copper wire mounted on wood poles feed the more distant processes, while nearby and less dangerous ones, such as charcoal grinders and carpenter shop, are supplied through a bank of three 50-kva., 2,300/220-volt transformers. At each building group is located a two-pole structure with overhead platform carrying a transformer bank protected by cutouts and lightning arresters. Remote control sectionalizing switches serve to isolate trouble that may occur in any process point in the plant.

Motors are of the squirrel-cage or slip-ring type, depending upon the particular application. The most interesting feature of this part of the installation is the location of the motors. No motors are housed in any building containing processes, but are placed in adjacent ironclad buildings and power is transmitted to powder-making machinery by long lineshafts or belts. The motor control equipment is placed before a small opening in the building wall so that the operator can reach it without entering. Large water tanks just outside several of these buildings furnish a convenient quenching pot for operators in case their clothes catch fire.

Besides having no motors in any process buildings, there is no electric wiring in any of them. Light is

No motors inside the mixing houses

The 40-hp. mixer drive motor is located in the iron-clad cabin at the right and power is transmitted by a belt through the covered tunnel to the mixers in the adjoining building.



Electrical distribution in a powder plant

Isolation of manufacturing processes in widely separated buildings necessitates distribution at 2,300 volts, overhead construction, the use of a comparatively large number of small and medium sized transformers and lightning arresters and fuses on all branches.

furnished by weatherproof gooseneck-type reflectors mounted on poles outside the windows.

Heat for eight of the buildings, averaging 14x24x8 ft. in size, is furnished by eight 10-kw., 220-volt, single-phase electric steam generators. Each of these is equipped with two standard 5-kw. water immersion heaters and operates at 8 lb. steam pressure. These generators consist of a horizontal boiler shell with centrally located steam dome. Each shell is tested for 100 lb. pressure and equipped with gage glass and cock, safety valve, automatic pressure regulator, magnetic switch and a three-heat switch for each 5-kw. heater. The outside of the generator is lagged with 2 in. of magnesia insulation. Each of these boilers is located in a small building outside the one it heats. Live steam and return condensate lines lead to heating pipes in the main building. Two winters have passed since these steam generators were installed and at all times the generators furnished sufficient heat to keep the buildings comfortable for workers.

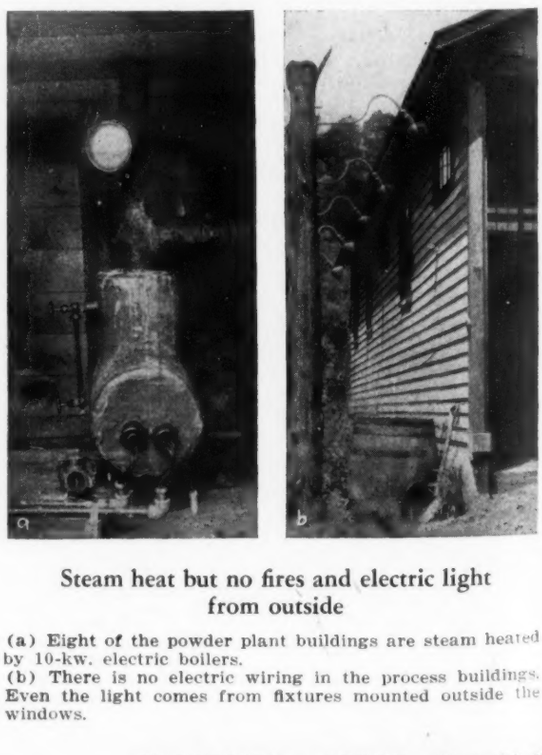
The basic components of the powder (sulphur, charcoal and sodium nitrate) are ground wet and mixed in the proper proportions by motor-driven machinery. For granulated powder this mixture is pressed into sheets, broken up and dried by mechanical agitation in wooden containers. To make "pellet" powder the mixture is pressed into pellets, which are stacked to form sticks, wrapped in paper and sealed by dipping in waterproofing materials.

For drying the pellet powder after being pressed, four Gehnrich ovens, heated by separate 60-kw., 220-volt heating units, are used. These consist of insulated cabinets containing heating elements with small motor-driven blowers on top. The incoming cool air passes through Reed air filters, over the heating elements and through a 40-ft.-long insulated underground conduit to the ovens, located in a building beyond an earthwork explosion barrier.

Heating elements are maintained at the proper temperature by control instruments and magnetic switches. As an additional precaution a temperature limit fuse is placed at the outlet of the heater units. An interlocking arrangement connects fan motor line switch, overload relays and temperature control instruments.

The material for dipping the pellet powder is melted in a 110-gal. Dopp kettle operating at 40 lb. steam pressure. This steam is supplied from a 10-kw., 220-volt, single-phase, 60-cycle electric steam generator having two 5-kw. immersion heaters.

About two years ago central-station power became available for this plant, and as the 400-kva. alternator was overloaded its use was discontinued and all the power requirements are purchased from the Kentucky & West Virginia Power Company. Energy is metered at the primary distribution voltage of the company, 2,300 volts, for which a credit of 5 per cent on the kilowatt-hours consumed is allowed. In addition the powder company receives a credit of 15 cents per kilovolt-ampere of contract capacity for ownership of secondary transforming equipment. Credit is also given for an average monthly power factor exceeding 85 per cent. Due to the large proportion of heating load, the power factor averages 94-96 per cent. At present the plant load consists of about 400 hp. in motors and 350 kw. in electric heat with very high load factor. These factors enable the powder company to earn a very low rate per kilowatt-hour.



Steam heat but no fires and electric light from outside

(a) Eight of the powder plant buildings are steam heated by 10-kw. electric boilers.
(b) There is no electric wiring in the process buildings. Even the light comes from fixtures mounted outside the windows.

READERS' FORUM

A New Thermodynamic Suggestion

To the Editor of the ELECTRICAL WORLD:

Relative to your editorial in the January 24 issue "A Transmission Pipe Dream," it may interest you to learn of certain methods for storage, transmission and regeneration of power on which I have devoted considerable effort.

As you know, the majority of large power systems operate at about 50 per cent load factor. In attempting to devise means for utilizing the very large capacities now idle during off-peak hours, I have worked on the principle of absorption of such power by means of electrolysis of water to form oxygen and hydrogen and have developed estimates on the transmission of these gases by means of high-pressure pipe lines, with final regeneration of power by means of a form of internal combustion engine using steam as the operating medium. This cycle allows a very wide temperature range, with correspondingly high thermal efficiencies. The source of heat energy for this engine, of course, is derived from the above two gases.

A net over-all efficiency of about 50 per cent, at least, seems capable of achievement, as shown by the following table:

	Per Cent
Conversion electric power, a.c. to d.c.	95 (rectifier)
Electrolysis	85 (Allan cells)
Regenerative heat engine	65 (from my studies)
Mechanical efficiency engine	93
Net over-all efficiency	48.8

The maximum thermal efficiency will be limited principally by the maximum superheat temperature which can be obtained on a working basis and the quantity of heat which can be absorbed by maintenance of an isothermic condition during the initial stages of expansion. The theoretical maximum efficiency for the temperature range on which the above 65 per cent thermal efficiency is based is about 84 per cent from the basic expression.

$$\text{Efficiency equals } \frac{T_2 - T_1}{T_2} \quad (T \text{ equals absolute temp.})$$

The transmission capacity of one 20-in. pipe line for hydrogen and one 26-in. pipe line for oxygen, operating from 500 lb. to 100 lb. per square inch pressure, 300 miles long, and without intermediate pumping stations, is some 600,000 kw. of regenerated capacity. With pipe line costs based on a general formula as developed for conditions in the Southeast, the investment for the above 300-mile line will be some $34,400,000. The comparative figure for ten 110-kv. double-circuit, 60,000-kva. steel tower lines, including terminal substations and without condensers, comes to about $49,200,000. Thus, electric transmission, without the consideration of extra high potentials or accessory equipment always necessary for such long jumps, figures some 1.4 times the cost of gas transmission in the above range of capacities. This difference will be very much increased by the addition of comparatively inexpensive pumping stations along the pipe lines and when the operating load factor of the pipe line can be made about 90 per cent, as against about 50 per cent for the electric line, is considered.

The heat engine for power regeneration operates on the following cycle: A high-pressure, high-temperature, water-cooled cylinder, similar to a two-cycle Diesel engine cylinder with separate compressor, is provided. The water jacket of this cylinder is built to withstand the initial pressure of the cycle, say 300 lb. per square inch. Saturated steam is admitted to the cylinder with a short cut-off, this steam originating in the cooling jacket under above pressure. At once, after closure of inlet valve, the steam charge is superheated to, say, 3,500 deg. F. by an oxyhydrogen flame in the cylinder. This charge of superheated steam is then expanded to a vacuum, the final stages of such expansion taking place either in low-pressure cylinders or in a steam turbine. In this cycle, then, the only major heat loss is in the condensate, since the heat absorbed in the cooling jacket forms live steam. It is found, of course, that where such extremely high initial temperatures are used very large expansion ratios are required for operation to low temperatures. However, with proper design of condenser systems, a portion of the heat loss in the condensate may be recovered.

You will note that the oxygen and hydrogen generated by off-peak power not only may be used as a power storage and transmission medium as above, but that they may be used in great amounts for oxide ore reduction and for other heavy industrial purposes. Estimates which I have made indicate a total production cost of about $18.30 per gross ton for commercially pure iron, where Southern ores are used and 3 mill power is available 24 hours per day.

These methods for exploitation of the values in off-peak capacities are, of course, not adaptable to hydro systems into which expensive storage capacities are built. They are adaptable to systems which are based on large flows and with little or no storage, as on the St. Lawrence and Tennessee Rivers and on the great falls of the São Francisco and Paraná Rivers of Brazil. Where very cheap fuel is available for ordinary steam plants it may be economical to utilize off-peak capacity by this means also.

Studies of the adaptation of oxyhydrogen power for locomotive operation indicate that this is practicable and that great economies can be had by such utilization. High load factor generating plants and transmission pipe lines would be used. Sufficient gas for five to twelve hours' operation is easily stored in pressure drums or spheres on the locomotive and tender. Very long pipe transmission lines may be used.

It seems very probable that co-operation among the power, railroad and steel industries could result in a basic improvement in the technical and economic status and that the competitive factors in the first two industries may be met.

A. U. AVERA,
Engineer.
Birmingham, Ala.

BOOK REVIEWS

Underground Systems Reference Book

Published by National Electric Light Association, New York. 400 pages, illustrated. Price to members, $4; non-members, $6.

This reference, compiled by a staff of well-informed engineers, presents valuable data on accepted practices and has been prepared for the man in the field as well as the man in the office. The introduction contains a non-technical, historical review of the development of underground systems, a brief general survey of modern underground practices and a discussion of the application of cables. Seven chapters are devoted to cable and cable insulation, conduit and manholes, installation splices and terminals, operation and miscellaneous equipment. for underground installations, and safety practices.

There is an appendix of general information and a bibliography of the literature on cables and underground practices published throughout the world. The references have been classified and indexed for convenient use. The book is bound in a durable waterproof cover and is profusely illustrated and minutely indexed. It is the first time that authoritative data and information on planning, constructing and operating underground systems, based on successful methods and practices of operating companies, has been published in convenient reference book form.

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Die Elektrischen Maschinen

By Dr.-Ing. M. Liwschitz and Dip.-Ing. H. Glöckner. G. B. Teubner, Leipzig and Berlin, Germany. Band 2. 306 pages, 462 illustrations, 13 chart inserts. Price, 19 reichsmarks.

This, being volume 2 of a treatise on electrical machinery, deals with installation and construction. The authors are chief engineers in the plants of a leading German electrical manufacturing company. The first part of the book is devoted to insulating materials, their properties and applications; the second part, constituting the remaining 80 per cent, takes up the properties of the structural material used in electrical machinery and the mechanics of the structural design. The individual elements of machines are considered in detail; the mode of applying formulas is shown by sample computations. The illustrations are well executed and liberally used; the line cuts, in particular, are commendably clear. The book is intended primarily for students and junior designing engineers, but also as a reference work.

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Electrical Equipment

By T. C. Lloyd. John Wiley & Sons, Inc., New York. 287 pages, illustrated. Price, $3.50.

Intended for use in a follow-up to the usual short introductory courses on the principles of electric circuits and machinery, this book is planned to acquaint non-electrical engineering students with commonly used types of electrical equipment. It presents a general survey of methods and devices used in electrical power engineering, including machinery, transmission, illumination, welding, protective apparatus and batteries.

In addition to a separate chapter on engineering economics, which is in itself a commendable feature, this aspect of the subject is kept more or less before the student's attention throughout the book. His thinking is made definite by an adequate number of problems for solution in connection with each chapter. Some of these afford training in the use of charts and tables of data. Teachers of non-electrical engineering students will find the book well adapted to their needs.

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Fahrzeit, Motorleistung and Wattstundenverbrauch bei Strassen- und Stadtschnellbahnen

By Dr. Ing. Hans Voigtlander. Julius Springer, Berlin, Germany. 64 pages. Price, 8.50 reichsmarks.

To shorten electric railway computations of the type involving speed-time curves the author presents a "percentage method" whereby certain parts of the work are done once for all. Characteristic curves are developed in such a form that the relationship expressed by them is of general rather than specific application, connecting the time of run, motor output, gear ratio, maximum current, average and maximum speed. A numerical example shows how the method is used in practice.

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Treatise on Leather Belting

By Geo. B. Haven and Geo. W. Swett. Published by the American Leather Belting Association, New York. 249 pages. Price, $1.50.

This thumb-indexed book takes the reader from the first step in leather manufacture through all stages of the work required to transform raw hide into finished belting and describes the different kinds of leather and their proper field of use. A multitude of facts of value to all users of power are given, including various grades and weights of belting available, the right pulley to use and why, practical rules governing the application of belts to machines, tables of horsepower developed at different belt speeds, proper use of idlers, short center drives and hinged motors for short center drives.

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Pocketbook of Electrical Rules and Tables

By Monro and Jamieson. (1931 edition.) J. B. Lippincott Company, Philadelphia, Pa. 765 pages. Price, $4.

This venerable handbook has now reached its 23d edition; sufficient proof of its accepted value. Originally intended as a handbook for engineers and electricians engaged on communication problems, it was later extended to include information on practically every branch of electrical engineering. Even though it must still be considered primarily as a communication handbook, it will make a valuable addition to the library of every electrical engineer, particularly if he be engaged on engineering for foreign countries, and more particularly those countries that use British standards. All the standard terms, standard units, standard wire gages, etc., are British, and are quite different from American standards. The term "ground," for instance, does not appear in this book. It is the British term "earth" and the American electrician would look in vain for a method of detecting a ground if he is not familiar with British standard terminology. Perhaps some day American and British engineers will unite on uniform standards.

Men of the Industry

M. T. Walker New President Southwestern Division, N.E.L.A.

MARSHALL T. WALKER, who was elected president of the Southwestern Geographic Division of the National Electric Light Association, as announced in the May 2 issue of the ELECTRICAL WORLD, is vice-president of the Southwestern Gas & Electric Company and manager of the Shreveport and Caddo divisions of that company. A native of

Alabama, Mr. Walker, after graduation from college, entered the employ of a utility company in Anniston giving gas, electric power and railway service. After completing technical studies at Pratt Institute he entered the testing laboratory of the Thomson-Houston Electric Company. Then he returned to Anniston for a short time before assuming the duties of manager of the Rockville Gas & Electric Company, Rockville, Conn.

After two years at Rockville, Mr. Walker went to Fort Madison, Iowa, to manage the gas company. From there he was transferred to Wausau, Wis., and after about two years in Wausau, he asked to be transferred South and was sent to Beaumont, Tex. The Beaumont utility company, shortly after his transfer, was merged with the Southwestern Gas & Electric Company, the general offices of which are in Shreveport, La., and in September, 1926, Mr. Walker was transferred to Shreveport.

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GARRETT A. CONNORS has been appointed vice-president, director of purchases of the Truscon Steel Company of Youngstown, Ohio. This recognition of Mr. Connors' ability is merited by his 24 years' service as an executive in the production division of Truscon. In his new capacity Mr. Connors will have complete charge of purchases for all Truscon plants, maintaining his headquarters in Youngstown, Ohio.

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MALCOLM C. CLEVELAND of New York City has been appointed chief engineer of the Public Service Commission of New York to fill the vacancy caused by the resignation of Charles R. Vanneman. Mr. Cleveland, who has been assistant chief engineer of the Lehigh Valley Railroad, comes to the important position of chief engineer of the commission with a wide experience in the various fields of engineering work, including connections with the Baltimore & Ohio Railroad, Cleveland, Cincinnati, Chicago & St. Louis Railroad, Michigan Central and the New York Central.

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JOSEPH W. ALSOP and EDWY. L. TAYLOR of New Haven have been appointed members of the Public Utilities Commission of Connecticut. Mr. Alsop was nominated to succeed himself for a six-year term and Mr. Taylor was nominated to fill the unexpired term of Charles C. Elwell, resigned. Mr. Taylor, a native of Albany, received his Ph.B. from Yale in 1901 and in the same year was appointed assistant instructor in the Sheffield Scientific School. He was connected with the New Haven road from 1904 to last January. The confirmation by the Legislature of the two appointments ends a deadlock between the Governor and the Legislature which has existed since March 24.

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DR. JAMES S. THOMAS, widely known educator, has been appointed to the position of economist for the Commonwealth & Southern Corporation with headquarters in Birmingham. Dr. Thomas' new duties will consist largely of the industrial promotion of the territory served by the company, particularly in Alabama and other Southern states, working in co-operation with industrialists and civic organizations. He recently spent several months in Europe gathering first-hand information on economic conditions. He has been in educational and economic work for more than eighteen years, during which time he has won national recognition. He established the extension division of the University of Alabama and served as its director until he resigned to go abroad.

R. F. Pack New President of Northern States Power

ROBERT F. PACK, who was elected president of the Northern States Power Company, as was announced in the May 9 issue of the ELECTRICAL WORLD, has been a nationally known figure in the utility industry for a number of years. Mr. Pack came to Toronto, Canada, from England in 1889 and entered the employ of the Toronto Electric Com-

pany in 1891, serving first as office boy and then holding successively the positions of accountant, comptroller, secretary and general manager, which latter position he resigned in 1912 to become associated with the Byllesby interests as general manager of the Minneapolis General Electric Company. Four years later he was appointed vice-president and general manager of the Northern States Power Company, also a Byllesby subsidiary.

This brief sketch of Mr. Pack's connections does not begin to indicate what he has contributed to the electric light and power industry, not only as one of its most progressive executives, but also as an active participator in the affairs of its representative engineering associations. In 1912 he was elected to the presidency of the Canadian Electrical Association, and while holding this office he was instrumental in bringing about the affiliation of the Canadian Electrical Association with the National Electric Light Association. In was in 1926 that Mr. Pack was elected president of the National Electric Light Association after a period of active service on its various committees. He is also a member of the American Institute of Electrical Engineers.

OBITUARY

Charles Day

CHARLES DAY, chairman of the board of Day & Zimmermann, Inc., died May 10 in the University Hospital, Philadelphia, after an illness of ten days. He was in his fifty-third year. Mr. Day was especially known as a specialist in public utility management and operation, although he first established a national reputation as an economist and exponent of manufacturing efficiency in industrial plants. After many years of successful

work in the manufacturing field he extended his interest to the public utility field, and it was not long before his contacts became far reaching, embracing both the technical and the financial phases of the business. At the time of his death he served as an officer or director of a large number of public utility companies and the firm of Day & Zimmermann is retained as consultant in many important undertakings.

Mr. Day was a native of Philadelphia and a graduate of the University of Pennsylvania. After a connection with an engineering company in Nicetown he aided in founding the firm of Dodge & Day in 1902 and five years later, when John E. Zimmermann entered the business, the name was changed to Day & Zimmermann, Inc. So firm a grasp had he of production methods and problems that he lectured for seven years on these and related subjects at the graduate school of business administration of Harvard University and also at Columbia and Lehigh. It was about 25 years ago that Day & Zimmermann extended its activities to include the public utility industry.

During the World War Mr. Day became a trustee of the Shipping Board Emergency Fleet Corporation and went to France with the director of munitions to confer with General Pershing. He was present at the war council of the Allies in 1917 and also served as a member of a civilian commission appointed by the Secretary of the Navy to investigate the efficiency of navy yards. He served on the directorate of the Pennsylvania Railroad Company, Interborough Rapid Transit Company, United Gas Improvement Company and Fidelity-Philadelphia Trust Company. He was a trustee of the University of Pennsylvania. Mr. Day was also active in association work, having been a member of the board of managers of the Franklin Institute and a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, the American Philosophical Society and other associations.

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DR. ING. E. G. FISCHINGER, well-known German electrical engineer, died recently in Dresden at the age of 71.

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J. M. BRADLEY, 77, one of the organizers of the old Birmingham Railway, Light & Power Company, Birmingham, Ala., and the Tidewater Railroad, died April 27 at the home of his son in Dallas, Tex., where he was residing at the time.

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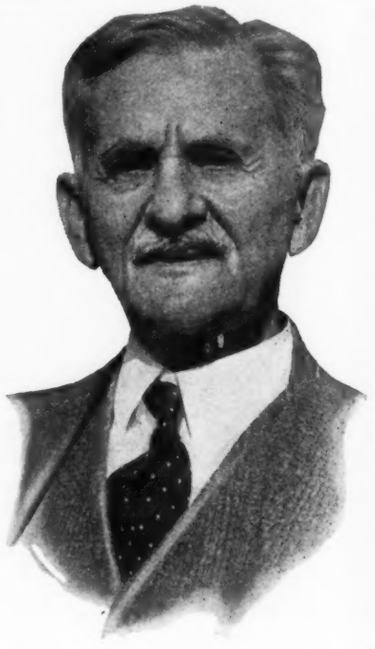
BENJAMIN C. PERKINS, vice-president of the Arrow-Hart & Hegeman Electric Company, Hartford, Conn., died May 3 in Liberty, N. Y., after a protracted illness. Mr. Perkins had been in ill health for the past two years and had not been active in business. Mr. Perkins' father was a pioneer in the development and manufacture of electric incandescent lamps and other electrical enterprises. He founded the Perkins Corporation, the immediate predecessor of the Arrow Electric Company. Benjamin Perkins was educated in Hartford schools and commenced his business career as the purchasing agent for the Perkins Corporation. The Arrow Electric Company was organized in 1903 and Mr. Perkins became secretary. He continued in that position until the Arrow Electric Company and the Hart & Hegeman Manufacturing Company were merged under the name of the Arrow-Hart & Hegeman Electric Company in 1927, when he was elected a vice-president and a director, continuing in both positions until his death. Mr. Perkins had shown marked interest and ability in the engineering and mechanical ends of the company's business and had contributed largely to its growth and success through numerous inventions.

Dr. Albert A. Michelson

DR. ALBERT A. MICHELSON, eminent physicist, died May 9 at his home in Pasadena, Cal., as the result of a cerebral hemorrhage. He was 78 years old. The world of science regarded Dr. Michelson as one of its great geniuses and every conceivable honor that the world of learning could bestow was his. He earned an international reputation for his researches in light and it was his work in this field which provided the foundation for the famous Einstein theory as well as for many other scientific formulas. Born in Strelno,



Germany, he was brought up in this country. He started his career in the Navy, and it was while holding an assignment in the department of physics at the Naval Academy at Annapolis that his penchant for things scientific was discovered. He resigned from the Navy in 1881 to become professor of physics at the Case School of Applied Science in Cleveland.

Professor Michelson went to Clark University and in 1892 became head of the department of physics at the University of Chicago. Here he continued his research work in spite of his administrative duties and special apparatus and instruments were developed with his characteristic enthusiasm. At the age of 77 this zealous scientist resigned from the faculty in Chicago, but removed to California to continue experiments on the speed of light.

During his distinguished career Professor Michelson received the Rumford medal of the Royal Society of London, the Nobel prize, the Grand Prix of the Paris Exposition of 1900, the Mattencci medal of the Societa Italiana, the Copley medal of the Royal Society of London and the Elliott Cresson medal.

Financial and Statistical News

PUBLIC utility issues were again the chief stronghold of the markets this week, but averages remain virtually unchanged. As stocks fluctuate listlessly within a narrow range, the number of issues loaning at a premium gradually increases, indicating a steadily growing short interest in the market. More than 25 issues are now said to be at a premium.

——POOL OPERATIONS IN THE MARKET are almost at a standstill owing to the unwillingness of the public to fall in line until a more definite trend is established. Brokers, however, generally agree that distress selling is now out of the way.

——ALTHOUGH UTILITY BONDS have shown little more than an upward tendency so far, there is a strong feeling that current easy money conditions, by reducing the attractiveness of short-term investments, must shortly induce buying of the longer term issues.

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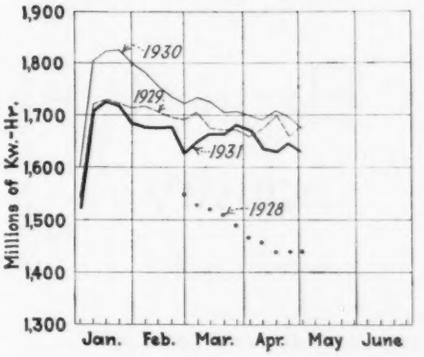
Weekly Energy Output



OUTPUT OF ELECTRIC light and power companies in the United States, as estimated by the statistical research department of the National Electric Light Association, is shown in the accompanying chart. For recent weeks and correspondingly in preceding years the energy generated was:

	——Millions of Kw.-Hr.——		
Week ended	1931	1930	1929
April 18	1,633	1,711	1,701
April 25	1,647	1,699	1,680
May 2	1,622	1,672	1,673
May 9	1,600	1,640	1,677

The central industrial area continues below last year's output, the eastern somewhat above.

Koppers Buys Into United Light & Power

ACQUISITION OF 180,000 additional shares of class A stock of United Light & Power Company have been secured by the Koppers Company of Pittsburgh, affiliate of the Mellon interests. This arises out of an option received in 1928 when the Koppers Company sold its holdings in American Light & Traction Company to United Light & Power Company.

United Light & Power has exchanged 4,961 class A shares for common stock of the Continental Gas & Electric Corporation and 7,930 shares of its class B voting stock for a minority interest in the Panhandle Power & Light Company, which is now entirely owned.

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$1,275,000,000 Added to Capital in 1930

PUBLIC UTILITIES IN THIS COUNTRY added $1,275,000,000 to their invested capital last year, according to Public Utility Points, an annual survey of the utility industry compiled by Bonbright & Company. This brings the industry's total capitalization to $28,000,000,000.

Electric power and light companies accounted for the largest gains and the greatest investment, with an increase of $700,000,000 in invested capital to a total of $11,800,000,000 in 1930. This compares with about $5,285,000,000 invested in electric railways, $5,000,000,000 in manufactured and natural gas, $4,950,000,000 in telephone and telegraph companies and about $900,000,000 in privately owned water supply facilities.

Every year since its inception in 1882, the survey says, revenues of the electric power and light industry have shown an increase over those of the preceding year. Gross income of all of the electric power and light companies in the country in 1902 aggregated approximately $85,700,000. In 1930 they amounted to more than 25 times as much. The gain in 1930 alone, as compared with 1929, was more than 3 per cent in spite of a small decrease in the number of kilowatt-hours sold.

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Investment Trusts Shift to Utility Stocks

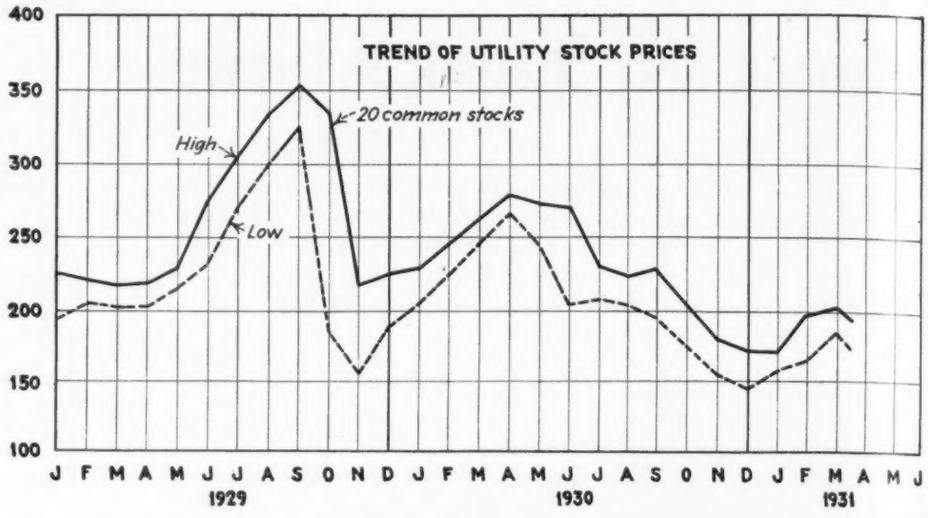
SOME of the power and light companies offer greater investment opportunities than any other branch of industry, a group of investment trust officers find. There has been a considerable shift to these stocks from rails and other classes, according to an analysis by Clark, Dodge & Company. The study is on the basis of number of trusts holding a given stock rather than the number of shares held. Of the 100 most popular stocks for investment of trust money, 23 were utilities, thirteen railroads, seven banks, one insurance company and 56 industrial concerns.

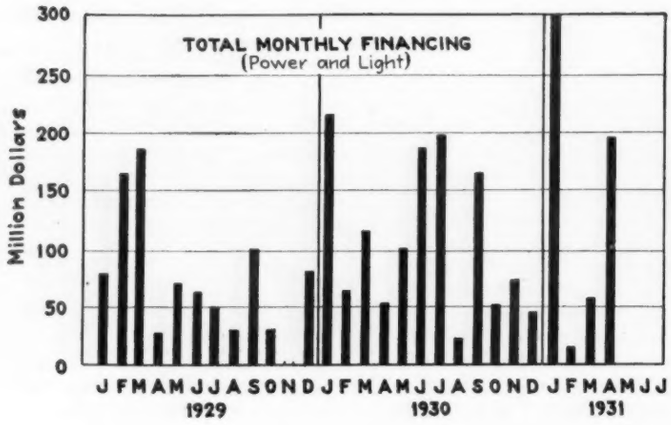
The most striking change during the year of the appraisal investment worth of company stock was a marking down of the railroads, most of the shift being to utilities.

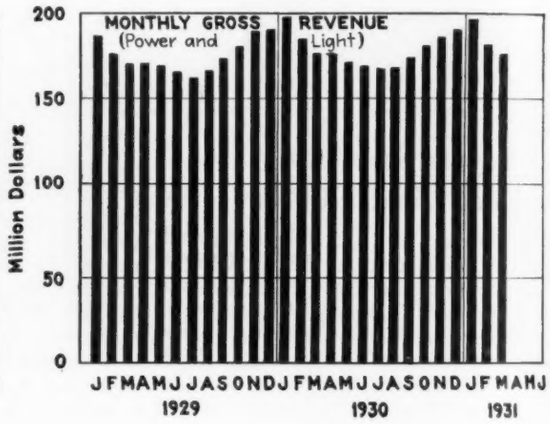
Some striking changes occurred in the appraisal of individual concerns. American Telephone & Telegraph was most popular, being held by 63 of the 91 trusts. It displaced Consolidated Gas of New York, now second, for the lead. U. S. Steel staged a long jump from twelfth place to third place and General Motors rose from 35th to fourth place. Electric Bond & Share changed from fourth to seventh, General Electric to eighth from fifth. American Can rose from fourteenth to ninth and American Gas & Electric to tenth from 24th. Other striking increases in appraised merit occurred in North America's rise to fourteenth from 22d, and Electric Power & Light from 48th to nineteenth. Columbia Gas & Electric moved down from eighth to 39th place and Commonwealth & Southern from nineteenth to 40th, presumably as a result of the dividend reduction.

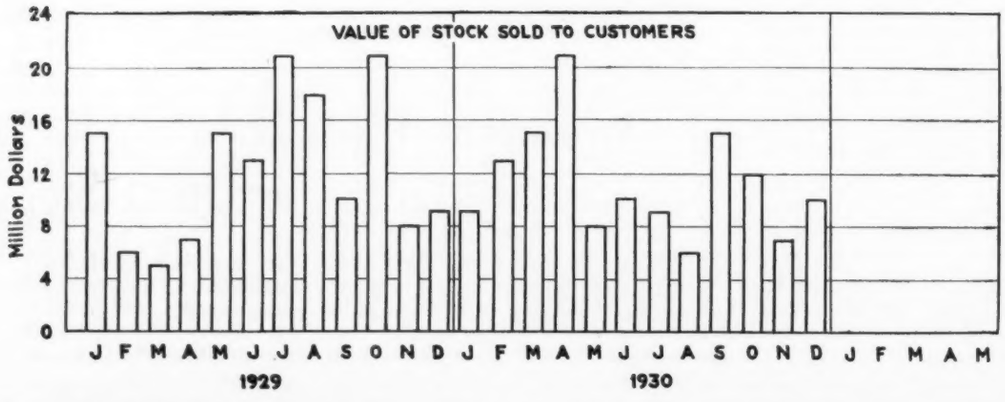
Business Trends in the Electrical Industry

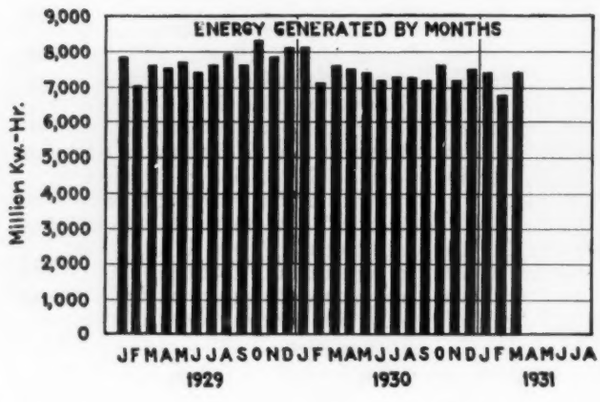
(Monthly Totals)

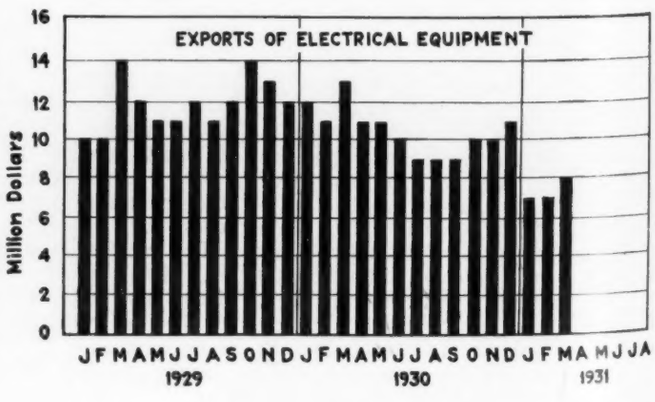












Few Industries Advanced in April

APRIL industrial operations, while receding somewhat from the rate of February and March, continued above midwinter conditions by a wider margin than in 1930 and by fully as great a one as in the spring of 1929. This is indicated by reports of electrical energy consumption by manufacturing plants throughout the country, received by the ELECTRICAL WORLD. Activity was 2 per cent less than in March, 12 per cent less than in April, 1930.

The deficiency compared with the corresponding month of the preceding year is smaller than it has been; from midsummer to January it was generally 18 or 20 per cent. A year ago industry was still on the downgrade, as the upper chart shows; at present the movement, despite fluctuations, seems to have turned.

Three lines advanced: Food products rose above both March, 1931, and April, 1930, levels; leather is 17 per cent above the preceding four-month average; the stone, clay and glass group, with cement manufacture an important constituent, is only 10 per cent below spring's level.

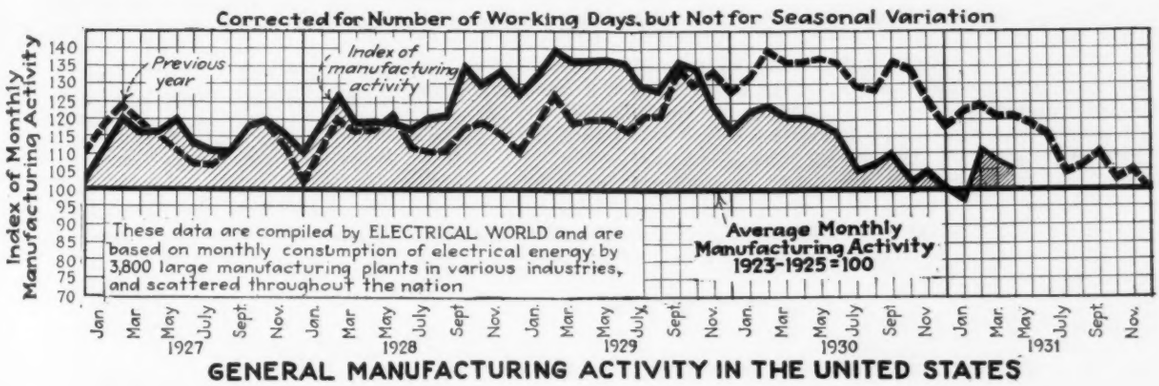
Both metal working and the iron and steel industry have dropped back approximately to the January level and 25 per cent below that of last April; the metals index, combining the two, declined 10 per cent.

In the automobile industry there was a moderate but quite unseasonal decline; compared with 1930, the April index is down 20 per cent. Incidentally, the latest available Department of Commerce index for Detroit factory employment (mid-April) is 24 per cent below last year's. Most other lines either maintained March levels or fell slightly.

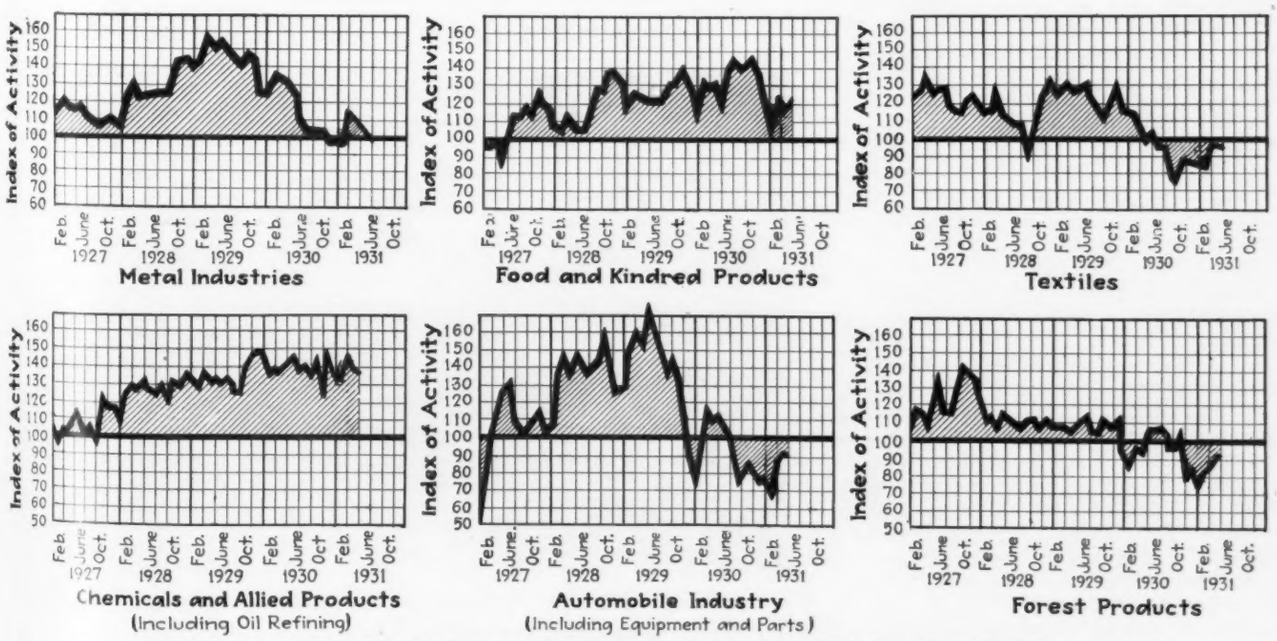
Index of Manufacturing Activity

Base: Average Month 1923-25

Industrial group	April, 1931	March, 1931	Feb., 1931	Jan., 1931	April, 1930
All industry	**105.7**	**108.2**	**110.3**	**97.6**	**120.2**
Automobiles (incl. parts and accessories)	90.8	94.1	88.9	67.5	112.9
Chemical products (incl. oil refining)	137.4	139.3	146.6	132.0	140.0
Food products	122.0	116.8	122.0	118.3	119.4
Iron and steel	108.1	119.4	116.5	103.4	138.3
Metal working	94.6	103.5	112.3	95.0	125.5
Leather products	83.9	71.2	76.1	71.6	91.2
Forest products	91.5	93.2	84.2	82.6	102.8
Paper and pulp	112.6	123.0	127.0	111.8	126.7
Rubber products	109.0	109.6	112.9	99.0	138.5
Shipbuilding	92.5	98.3	114.8	113.9	130.1
Stone, clay and glass	116.5	105.1	102.6	75.3	129.9
Textiles	95.3	97.3	99.3	86.4	102.3


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925=100
1927
1928
1929
1930
1931

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Refrigeration Division of N.E.M.A. Discusses Dealer Co-operation

AT A meeting of the refrigeration division of the National Electrical Manufacturers' Association in New York recently promotion of the A.S.A. Code, legislative activities, a model ordinance, warranties, co-operation with dealers, the ice industry and frozen food interests and other matters were discussed. Two subcommittees, respectively on patents and traffic, were appointed.

S. L. Nicholson of the uniform legislation committee and the industrial policies committee of N.E.M.A. described the work of these committees in matters pertaining to ordinances and legislation and indicated the value to the division of activities already in progress and their relation to the work the division contemplates undertaking.

Mr. Nicholson offered assistance to the division in matters within the committees' scope and of concern to the refrigeration industry. Discussion developed that there are several situations of particular interest to the division that will be investigated by these committees.

In conformance with previous request, A. W. Berresford, managing director of N.E.M.A., offered a plan of operation and an estimated budget for divisional promulgation of the A.S.A. Safety Code for mechanical refrigeration. The plan embraced the services of an individual who will devote his entire time to the work and outlined the desirable qualifications of this individual. After detailed consideration of the entire matter, the codes and ordinances committee of the division was instructed to select several candidates for this position, the final selection to be made by Mr. Berresford in consultation with the advisory committee.

A. M. Terry, chairman of the codes and ordinances committee, reported that the committee had under consideration a proposed uniform refrigeration ordinance. After reading the ordinance, he pointed out some phases which the committee felt might be improved. The division approved the suggested changes and instructed the committee to continue development of the ordinance and, when it has reached agreement, to refer the material to the law and legislative committee of N.E.M.A., after which it is to be submitted to the division and to the board for final approval.

Commercial practices committee

Col. F. E. Smith, chairman of the commercial practices committee, reported that copies of various forms of warranties had been received from members and the committee decided to attempt the preparation of a single warranty; G. S. Smith was delegated to prepare the original draft. The division referred the entire matter back to the committee for further consideration and report at later meeting.

This committee reported that it had contacted with the committee on telegraph code for the electrical industry and had furnished the committee with copies of individual code books of some of the members.

In conformance with a former action of the division, Colonel Smith announced that the commercial practices committee had made the following selections for the patents subcommittee and the traffic subcommittee:

PATENTS SUBCOMMITTEE—F. W. Swezey, Westinghouse Electric & Manufacturing Company, chairman; L. D. Burch, patent attorney of Kelvinator Corporation; J. King Harness, Harness, Dickey, Pierce & Ham, representing Copeland Products; Carlton Hill, Charles W. Hills, representing Norge Corporation; Cedric G. Smith, General Electric Company; E. T. Williams, Servel, Inc.

TRAFFIC SUBCOMMITTEE—J. E. Chamberlain (of Kelvinator Corp.) O. G. Lonskey, Copeland Products; Sam Marks, Westinghouse Electric & Manufacturing Company; Albert McGinness, Servel, Inc.; Glen C. Wasson, General Electric Company.

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Standardization of Insulators

THE SCOPE OF THE WORK on standardization of insulators for electric power lines which will be undertaken by an A.S.A. technical committee has been officially defined by the standards council of the American Standards Association. The scope as approved by the council is as follows:

Specifications, including rating, dimensions for interchangeability and tests, for line insulators of all types except those used for communication lines.

The American Institute of Electrical Engineers and the National Electrical Manufacturers' Association, sponsors for the project under the procedure of A.S.A., have practically completed plans for the organization of the committee which will have charge of the work of developing the standard.

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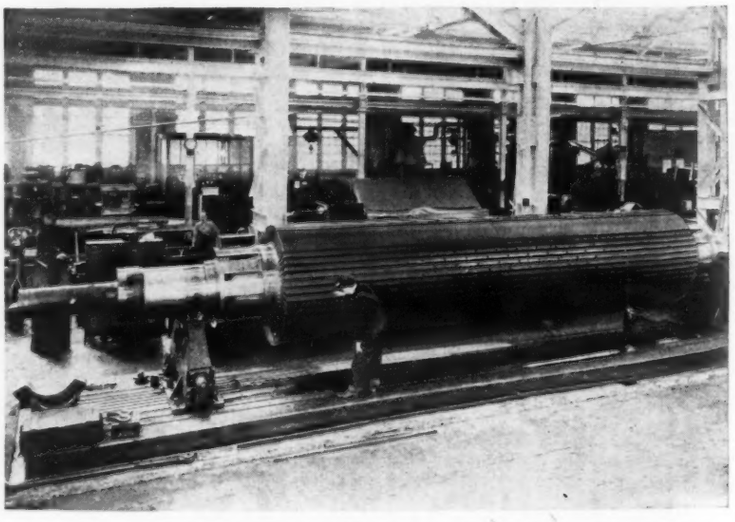
ROTOR FORGING FOR TURBO-GENERATOR



The partially machined rotor forging for a 160,000-kw. turbo-generator, two of which are under construction at the Schenectady Works of the General Electric Company for the Brooklyn Edison Company.

N.E.M.A. Will Resume Publishing Bulletin

BEGINNING IN JUNE N.E.M.A. will resume the periodical issue of an association publication. This decision in no sense indicates lack of appreciation of the co-operation accorded the association by the electrical trade journals during the last half year, officials state.

Abandonment of the previous publication gave the subject prominence and produced constructive suggestions which, however, for their embodiment, demanded a man of exceptionally wide industry experience and contact.

This requirement has been met by obtaining the services of Ralph W. E. Moore. Long affiliated with the Westinghouse company, he has been prominent in the work of the association itself. In 1930 he was one of the two manufacturer recipients of the McGraw-Hill award, accorded him for his constructive work in the field of electrical safety. His activities have been numerous and include committee affiliations in most of the existing trade and engineering associations of the industry. That all of this work has been based on a foundation of commercial practicality and knowledge is the factor which has made it so prominently of service.

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Claude Neon Lights Issues Report

FOR THE YEAR ENDED December 31, 1930, net profit of $268,060 has been announced by Claude Neon Lights, Inc. In addition the company's proportionate interest in net profits, after deducting dividends, of affiliated companies' reported profits for 1930 and increased deferred gross income, totaled $339,888.

The business of Claude Neon Lights, Inc., and its licensed companies for 1930 amounted to approximately $15,349,500, against $15,778,900 for 1929. With the rapidly increasing interest in tubular sign displays, an increasingly large volume of business is anticipated over the next several years, while the new field of general illumination offers greatly extended opportunities far beyond the original field of electrical signs and displays.

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Westinghouse Gets Safe Harbor Order

AN ORDER OF OVER $250,000 has been awarded by the Safe Harbor Water Power Corporation to the Westinghouse Electric & Manufacturing Company for 32 type "0-44" and 4 type "Go-3" oil circuit breakers. The former have a published interrupting rating of 1,500,000 kva., the latter 1,000,000 kva. The breakers are to be equipped with "Deion" arc-interrupting devices. Each will interrupt the rate of power required to light all the homes in New York City; some in approximately 1/12 of a second, others in 2/10 of a second, according to requirements.

These breakers will be installed at Safe Harbor, Pa., on the Susquehanna River about 75 miles northwest of Baltimore. They will protect electrical equipment valued at over five million dollars.

They will be built at the East Pittsburgh Works of the Westinghouse Electric & Manufacturing Company. It is estimated that 200 men will work on them. Twenty-four breakers are scheduled to be shipped in September, the balance at a later date.

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New York Metal Prices

	May 6, 1931 Cents per Pound	May 13, 1931 Cents per Pound
Copper, electrolytic	9	9
Lead Am S & R price	4	3¾
Antimony	6.70	6.65
Nickel, ingot	35	35
Zinc, spots	3.60	3.65
Tin, Straits	23.40	23¼
Aluminum, 99 per cent.	23.30	23.30

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DELINQUENT ELECTRICAL ACCOUNTS

(National Electrical Credit Association)

Number of Accounts Reported

Division	April 1930	April 1931	Per Cent Inc. or Dec.	Four Months 1930	Four Months 1931	Per Cent Inc. or Dec.
New York	331	346	+ 4.5	1,327	1,161	—12.5
Middle and Southern Atlantic	174	121	—30.5	801	533	—33.5
New England	181	105	—42.0	566	391	—31.0
Central	807	686	—15.0	3,281	2,638	—19.6
Total	1,493	1,258	—15.7	5,975	4,723	—21.0

Total Amounts Reported

Division	April 1930	April 1931	Per Cent Inc. or Dec.	Four Months 1930	Four Months 1931	Per Cent Inc. or Dec.
New York	$51,842	$31,598	—39.0	$237,539	$147,507	—37.9
Middle and Southern Atlantic	26,071	14,674	—43.7	118,414	71,547	—39.6
New England	24,670	9,407	—61.9	87,337	35,802	—59.0
Central	100,988	57,164	—43.4	469,768	241,439	—48.6
Total	$203,571	$112,843	—44.6	$913,058	$496,295	—45.6

Allis-Chalmers Expands in Other Lines

IN ADDITION TO THE PURCHASE of certain assets of the Advance-Rumely Corporation, Allis-Chalmers Manufacturing Company is said to be expanding in other directions. It is understood, for example, to be seeking an electrical manufacturing concern in New England and the proposed purchase of some of the American Brown Boveri properties is rumored.

A tentative contract has been approved with the directors of Advance-Rumely Corporation and a meeting of stockholders is called for May 29 to vote on the proposal. This contract provides that Allis-Chalmers will acquire the assets of Advance-Rumely with certain exceptions.

Rumor has it that certain other mergers and purchases are being actively considered in the electrical manufacturing industry. Such discussions, as yet unconfirmed, are chiefly along the lines of tying in units in collateral fields rather than duplicating existing lines.

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TRADE BRIEFS

Automatic Electric, Inc., Chicago, has published a bulletin called the Strowger Power Supervisor's Board, which is available for distribution.

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General Electric Supply Corporation, a subsidiary of the General Electric Company of Schenectady, has acquired the Robertson-Cataract Electric Company and the Falls Equipment Company, Inc. The deal approximated $1,000,000. The Falls Equipment Company was to be taken over May 1 and the Robertson-Cataract June 1.

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Standard Transformer Company, Warren, Ohio, has appointed L. J. Gregory, as its representative in the Cincinnati district, J. C. McDougal in Oregon and Washington and T. J. Richards in the northern Ohio section.

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Industrial Products Company, 3729 Old York Road, Philadelphia, will move to its new office at 800 West Somerset Street on June 1.

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At its annual meeting held recently Allis-Chalmers Manufacturing Company declared a quarterly dividend of 50 cents, placing the stock on a $2 annual basis, against $3 paid previously.

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Shepard Niles Crane & Hoist Corporation announces the appointment of the Elliott Electric Company, Cleveland, Ohio, and A. G. Acker as local representatives for Sprague electric hoist and winches.

Market Conditions

CONTRACTS continue to improve in the Eastern district. Central-station buying is more active, while industrial, marine and railway business are all steadily gathering some momentum, if small at first. Small-lot orders combine to make up fair totals in the New England area.

——PACIFIC COAST BUSINESS has been decidedly spotty this week, although power business is still shaping up well. There has been an unusually large volume of machinery orders.

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EASTERN

—ORDERS CONTINUE *on a better basis for electrical equipment in the Eastern district and contracts are reaching a sizable total for a variety of apparatus. Central-station account is growing more active with the advent of spring and inquiries look promising from that quarter.*

—INDUSTRIAL BUSINESS *shows better strength and the call for motors, controls and accessory apparatus is better than at any time for several weeks. Marine and railway accounts are gathering momentum after a period of inactivity, and with expanding operations at shipyards throughout the country, marine equipment is expected to develop some worth-while totals within the next month or six weeks.*

A paper mill in northern New York has contracted with a state maker for waterwheel and generating equipment to cost about $30,000. The Peerless Electric Company has secured an order from a jobber for fractional-horsepower motors to an amount of $250,000, and also reports a sizable volume of advance orders for electric fans. General Electric Company will furnish motors, controls and other equipment for an electrification program at plant of the Tin Decorating Company, Baltimore, Md. The company has secured an award for 36,000 lb. of bare copper cable for city of Los Angeles, Calif., at $13.03 per hundredweight, through its subsidiary, General Electric Supply Company.

Safe Harbor Water Power Corporation has contracted with Westinghouse Electric & Manufacturing Company for a total of 32 oil circuit breakers, with interrupting devices and complete accessories for its hydro-electric generating project now in progress at Safe Harbor, Pa., the order aggregating over $250,000. General Electric Company has taken an award for electrical equipment for a 150-ft. combination hydraulic and clamshell dredge, now being built by the Nashville Bridge Company; the hydraulic machinery will be furnished by Bucyrus-Erie Company.

Pennsylvania Railroad Company is expected to purchase considerable equipment in the coming weeks; the company will proceed with its building and electrification program at Baltimore and vicinity, estimated to cost $22,000,000 over a period of months. Equipment orders will soon be placed by the railroad for a new river-rail terminal at Baden, Pa., to cost $325,000, exclusive of construction. Westinghouse Electric & Manufacturing Company will furnish electrical apparatus for two pusher locomotives to be used on the ore docks of the Pennsylvania Railroad at Cleveland; the locomotives will be built by Atlas Car & Manufacturing Company, each requiring two 112-hp. motors, with third rail operation. Westinghouse company has also taken an order for complete Diesel electric equipment for a new yacht to be built at the yard of the Bath Iron Works, Bath, Me., including all switching and control apparatus.

CONSTRUCTION PROJECTS

Board of Transportation, New York, will soon take bids for second half of city subway system, totaling over 100 miles, to cost close to $438,000,000. Southern Alkali Corporation, affiliated with the American Cyanamid Company, New York, plans alkali and chemical plant at Corpus Christi, Tex., to cost over $3,000,000. Signal Officer, Signal Corps, United States Army, Army Base, Brooklyn, N. Y., will receive bids until May 29 for mast caps, mast plates, connectors, etc. (Circular 145); also, until June 3, for seven projector equipments, drying racks, etc. (Circular 153). Board of trustees, New York University, New York, has plans for first unit of gymnasium to cost $158,000, with ultimate cost of $875,000. Department of Sanitation, New York, has preliminary plans for group of 33 sewage disposal plants to cost $158,775,000. Lever Brothers, Cambridge, Mass., plan soap and perfumery plant at Edgewater, N. J., where property has been purchased, to cost over $500,000. Port of New York Authority, New York, will receive bids until May 25, for electrical equipment for new George Washington Bridge over Hudson River. Division of Purchases and Sales, General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until May 25 for voltmeters, electric oven heating equipment, ammeters and electric hoists.

SOUTHWEST

—NO CHANGE IN BUSINESS CONDITIONS *has been noted from reports of manufacturers, utility operators or jobbers. There is the same moderate but steady demand for stock sizes of motors and transformers, with practically no activity in transmission line material.*

There is also a very small amount of electrical appliances being moved. The only contract worthy of mention is for a 2,500-kw. generator for connection to Diesel engine costing $1,200. This is for a power company in the western part of this district.

CONSTRUCTION PROJECTS

Walcott & Lincoln, Inc., Kansas City, Mo., have approved plans for addition to grain elevator at Wellington, Kan., to cost $175,000. Wabash Railroad Company, St. Louis, Mo., has taken out a permit for addition to grain elevator at North Kansas City, Mo., to cost $250,000. Enid Terminal Elevator Company, Enid, Okla., plans addition to grain elevator to cost over $175,000. Houston Oil Company, Houston, Tex., plans addition to oil refining plant at Viola, near Corpus Christi, Tex., to cost more than $500,000. Construction Quartermaster, Shreveport, La., will receive bids until May 28 for industrial buildings at Barksdale aircraft field.

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NEW ENGLAND

—SMALL LOT SALES OF MOTORS, *together with a fair movement of general scheduled material, featured the trend in sales of electrical equipment in this district during the past week. Heavy electrical equipment is quiet and the demand for central-station supplies spotty.*

Scattered sales of line materials were reported by one prominent distributor. Special electrical equipment sales are uneven, though recently a 6½-ton electric truck was sold to a cable company. Inquiries for new equipment are running behind last year, according to one manufacturer. Materials for a new substation in western Massachusetts have been placed; plans for an expenditure of about $350,000 for underground distribution system are announced by the Pittsfield (Mass.) Electric Company. New substation projects include one for Boston Elevated Railway.

CONSTRUCTION PROJECTS

Vermont Newspaper Corporation, Bellows Falls, Vt., plans printing and publishing plant to cost close to $100,000, with equipment. Boston Port Development Company, Boston, Mass., plans oil storage and distributing plant at Revere, to cost about $250,000. State Department of Education, Boston, Mass., plans practical arts building at State Normal School, Fitchburg, to cost $150,000.

PACIFIC COAST

—THE PAST WEEK *is featured by exceedingly spotty business, there having been fair industrial and poor railroad business, much small construction reported, quiet retailing and good power business, which is furnishing the backbone of orders being placed.*

—MACHINERY ORDERS *are again good, but nearly all other kinds of business are scattered and in small quantities.*

Outstanding orders during the past week have covered a $35,000 award by the city of Los Angeles for three-conductor, 500,000-circ.mil sector cable, a batch of Westinghouse induction regulators for various San Francisco and valley locations, approximate value $25,000; elevator motors and controls for a San Francisco office building, $22,000; 250 and 350-hp. Westinghouse synchronous compressor motors, valued at $20,000, for the Hoover Dam; a $20,000 radio transmitting equipment for the Mare Island Navy Yard. The outstanding order covers a $60,000 assortment of General Electric transformers for Station H in San Francisco.

The present retail depression has hit various American Pacific Islands, but a $10,000 assortment of Westinghouse substation transformers and oil circuit breakers was made to Honolulu. Manufacturers report that distributing transformers and irrigation motors are moving markedly better, but dealers in districts hitherto very busy this time of year report that they are turning away orders daily for lack of cash of their farmer customers, whose crop prospects for 1931 are poor through lack of rain, thus making a vicious circle. The recent conduit flurry has made that market temporarily quiet, but good business in knobs and tubes and flexible metallic conduit is reported.

Other recent orders cover awards totaling $20,000 for San Francisco boulevard street-lighting systems, a $2,000 submarine cable bid for the government, two carloads of poles for Ukiah, a $2,300 award for the Boulder Dam telephone line, $9,000 worth of General Electric oil circuits breakers for bay shore installations. Prospective business includes a series of 33 theaters to be constructed by the United Artists in seven Western states and lamp bids varying from $2,500 to $20,000 for Berkeley, Oakland, Fresno and various central California municipalities. The Gilroy and Salinas Valley district is reported flourishing.

Call for bids for assembling and installing electrical machinery and equipment in the Diablo power house for the city of Seattle, the work estimated to cost between $200,000 and $300,000, has been canceled by the Board of Public Works. Figures were to have been opened May 15 and no new date has been set. Idaho Falls, Idaho, opened bids on May 12 for approximately $55,000 worth of hydro-electric equipment, including a 1,500-kva. generator, an 1,800-hp. vertical turbine and three 1,000-kva. transformers. Awards are expected within a few days. Westinghouse secured the initial order of 50 motors, ranging from 150 hp. down, for installation in the Longview plant of the Longview Pulp & Paper Company and additional motor orders for the plant are expected shortly. Other sales reported last week include 50 machines from 200 hp. down to pulp and paper mills, sawmills and miscellaneous sources, 25 from 50 hp. down to woodworking plants and small industrials, twelve motors, mostly 10 hp., to a cannery and eighteen machines from 50 hp. down to dealers, orchards and irrigation districts.

CONSTRUCTION PROJECTS

Midland Counties Power Company, Fresno, Calif., plans steel pole transmission line from Los Alamos to Buellton, Calif., with construction of power substation at latter place, to cost $125,000. Signal Officer, Ninth Corps Area, Presidio, San Francisco, Calif., will receive bids until May 29 for one 200-line telephone switchboard, duct lines, poles, cables, etc. (Circular 6). Pacific Gas & Electric Company, San Francisco, Calif., plans power substation on East Broderick Street to cost $90,000. RKO Studios, Los Angeles, Calif., will take bids for a film laboratory to cost $200,000. State Board of Control, Salem, Ore., contemplates an electric power plant for institutional buildings, to cost $150,000.

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SOUTHEAST

—ACTIVITIES IN THE *Southesat continue quiet, but the tone is more or less cheerful, the attitude being that since conditions cannot get worse they are bound to get better.*

Voltage regulators amounting to $8,000 to $9,000 were ordered last week for three affiliated companies and a North Carolina company ordered 10,000 lb. of "Hitenso" B.B. A Georgia power company's distribution transformer orders last week totaled $4,800, while a North Carolina company ordered similar equipment amounting to $2,500. A Georgia company ordered $3,100 worth of metering equipment and a Tennessee company $2,500 worth of disconnect switches. A textile mill in South Carolina ordered motor and control equipment amounting to $5,000 and a woolen mill in Georgia ordered stoker equipment amounting to $3,000. An announcement is expected shortly on a North Carolina textile mill addition which will involve 1,200 hp. in motor equipment. The State Highway Department at New Orleans ordered $9,000 in motors and control equipment covering drawbridge work.

CONSTRUCTION PROJECTS

Sylvania Industrial Corporation, Fredericksburg, Va., plans additions to transparent cellulose paper mill to cost more than $700,000. G. F. Vaughan Tobacco Company, Lexington, Ky., plans addition to plant at Danville, Ky., including electric light and power station, reported to cost over $85,000. Champion Fibre Company, Canton, N. C., plans expansion and improvement program in mill to cost over $150,000. Division of Supplies, Department of Commerce, Washington, D. C., will receive bids until May 26 for installation of airway lighting equipment on Meridian, Miss.-Birmingham, Ala., airway.

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MIDDLE WEST

—GENERAL BUSINESS IN THE *Middle West section continues to mark time. The volume is holding up fairly well and the easing up of the credit situation is expected, in the long run, to reflect favorably upon business. A somewhat mixed trend is noticeable, although the major activities continue to maintain their positions.*

—SOME IMPROVEMENT *in industrial activity is observed, with an increase in employment reported in several of the large centers.*

General building in the suburban area showed an increase the first four months of the year over a similar period last year, and car loadings are holding up fairly well, possibly indicating stabilization at recent levels. The coming jubilee celebration in Chicago it is hoped will provide business with its much-needed impetus. Among the interesting items placed this week were six 1,200-amp., 69-kw., 1,000,000-kva., interrupting capacity single-pole, single-throw, frame-mounted, solenoid-operated oil circuit breakers and one 60-cell operating bus battery.

CONSTRUCTION PROJECTS

De Pere Paper Company, West De Pere, Wis., contemplates improvements in mill to cost over $75,000. Wisconsin Public Service Corporation, Green Bay, Wis., plans addition to local power plant to cost over $85,000. Gulf Refining Company, Pittsburgh, Pa., plans oil storage and distributing plant at River Rouge, Detroit, Mich., to cost $125,000. Signal Corps, United States Army, Procurement District, Chicago, Ill., will receive bids until May 26 for switchboard cable, terminal boxes and other electrical supplies (Circular 64); also, at same time, for induction coils, ringing condensers, switchboard sections, flasher assemblies and other electrical equipment (Circular 63). Cook County Supervisors, Chicago, Ill., will soon take bids for training school and nurses' home at county hospital, to cost $2,350,000. Otter Tail Power Company, Fergus Falls, Minn., contemplates extensions in power plant at Wahpeton, N. D., to cost over $150,000.

New Equipment Available

Trench Cable Resists Acids and Moisture

A NEW UNDERGROUND CABLE, known as "Flexlay," has been announced by the National Electric Products Corporation, Pittsburgh, Pa. It is a flexible, highly insulated underground wiring system and is produced in three different types, non-metallic, semi-metallic and full-metallic, which is better known as parkway cable. "Flexlay" may be laid in

open trench without damage from abrasive handling, eliminating the use of clay or fiber ducts. They are so constructed as to resist the action of soil textures, soil acids and prevailing moisture contents.

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Bendable, Easily Threaded Rigid Conduit

RIGID CONDUIT WHOSE smaller sizes can be bent across the knee without tools is the newest improvement in wiring construction materials announced by the merchandise department of the General Electric Company. The new conduit also is cut and threaded more easily, it is claimed, giving a clean-cut, firm-holding thread. The steel is fine grained and of uniform quality, so that the pickling and galvanizing processes give a smooth product.

This is the result of the development of a new kind of flexible alloy steel, now used in all General Electric rigid conduit in sizes adapted to hand bending. Its flexibility also assures freedom from breaks that occur with more brittle types of conduit.

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Rugged, Weather-Resisting Wide-Angle Floodlight

A NEW OPEN TYPE, wide-angle floodlight, known as the Benjamin play area floodlight, has been placed on the market by the Benjamin Electric Manufacturing Company, Des Plaines, Ill. It meets the following requirements of lighting for outdoor sport and recreation: It provides uniform and strong illumination on the ground and to the front and sides of the unit; directs adequate light on vertical surfaces to be illuminated, such as players, apparatus, and other objects; also directs part of the light into the upper areas, permitting players and spectators to follow an object in flight, such as a baseball or football. It minimizes annoying glare by shielding the lamp and prevents it from interfering with the vision of the players or spectators.

The floodlight is ruggedly built for outdoor service and is weatherproof. The porcelain enameled reflector never needs repainting or refinishing and the inner reflector of aluminum oxide finish is non-corrosive.

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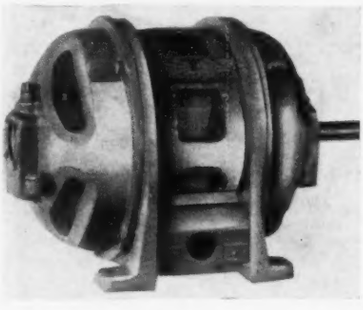
Replaceable Units to Aid Motor Repairs

AN IMPORTANT INNOVATION in motor design, making the different parts of the motor entirely separate units, has been incorporated in the design of the new W-frame type CS squirrel-cage induction motor, put on the market by the Westinghouse Electric & Manufacturing Company. Having adopted the separate parts idea, the company has only to keep the number of standardized parts in stock to be able to build, on short notice, a motor for a specific application. The new design makes maintenance simpler and less expensive, be-



cause damaged electrical parts can be replaced without replacing or rewinding the motor.

In the new induction motor the stator core is pressed into the motor frame. When it becomes necessary to replace a damaged winding, the old core and its winding is pressed out as a unit by means of an ordinary arbor press and a new "pre-wound" core pressed in; then, after the motor is reassembled, it is ready for use, the entire operation of replacing the damaged winding usually having been performed in less than an hour. The rotor also is a complete separate unit, and both the rotor and the stator core and winding can be supplied as such for built-in motor or repair purposes.

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Parallel or Gutter Tap Solderless Connectors

A NEW TYPE OF SOLDERLESS parallel or gutter tap designed to save space has been announced by Dossert & Company,

New York. This connector is made in two forms, type W, which clamps both conductors by tightening three bolts, and type X, in which the branch connection is held by a split sleeve and jam nut with set screw.

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Oil Test Set Safer and More Accurate

TWO NEW FEATURES in portable equipment for oil testing are to be found in the "AmerTran" type TS-6B test set, put on the market by the American Transformer Company, Newark. The first is a safety device making it impossible to come in contact with high-voltage parts while the set is in operation. The other permits more precise results by providing a means for increasing the test voltage from zero to maximum at a rate of approximately 3 kv. per second.

The new set is housed in a welded sheet-steel case of compact design and employs a 30-kv. testing transformer with a rating of 0.5 kva. Other equipment includes circuit breaker, voltmeter, wire-wound potentiometer, bakelite oil cup, pilot light, power switch and detachable connection cord for connecting the set with 110-volt, 60-cycle power circuits.